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AMERICAN MACHINIST

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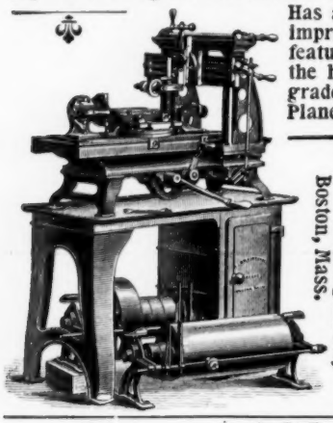

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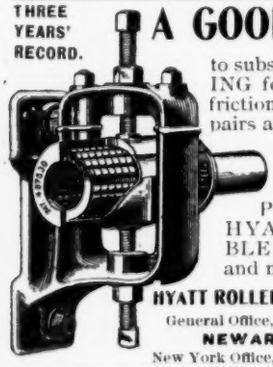

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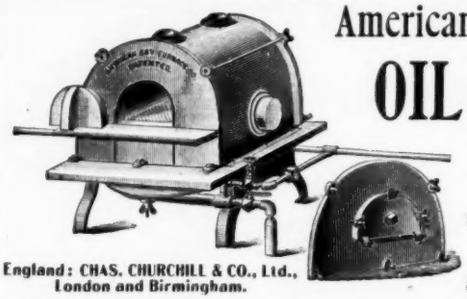

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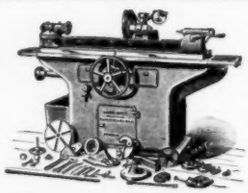

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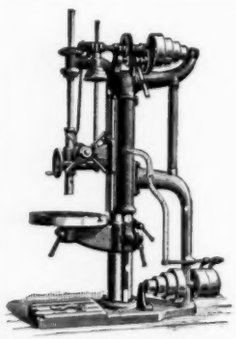

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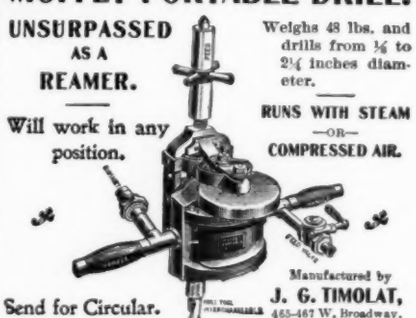

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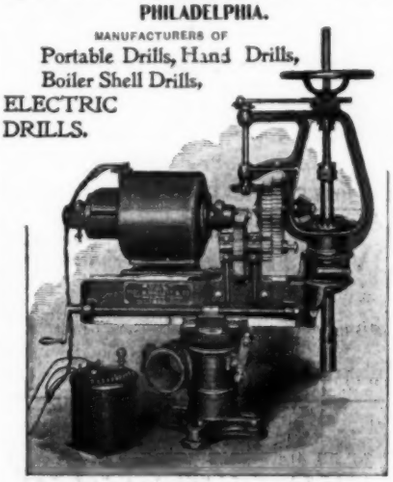

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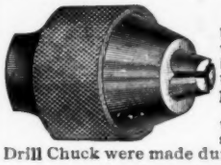

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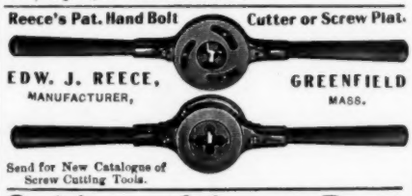

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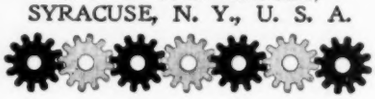

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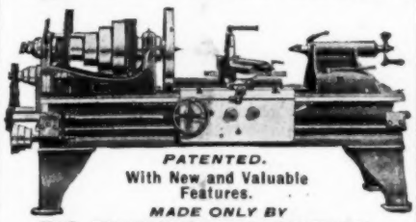

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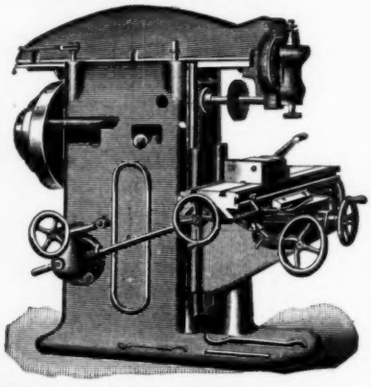

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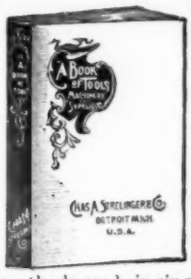

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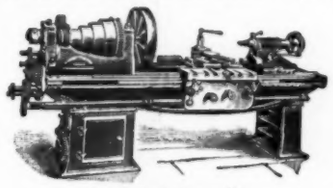

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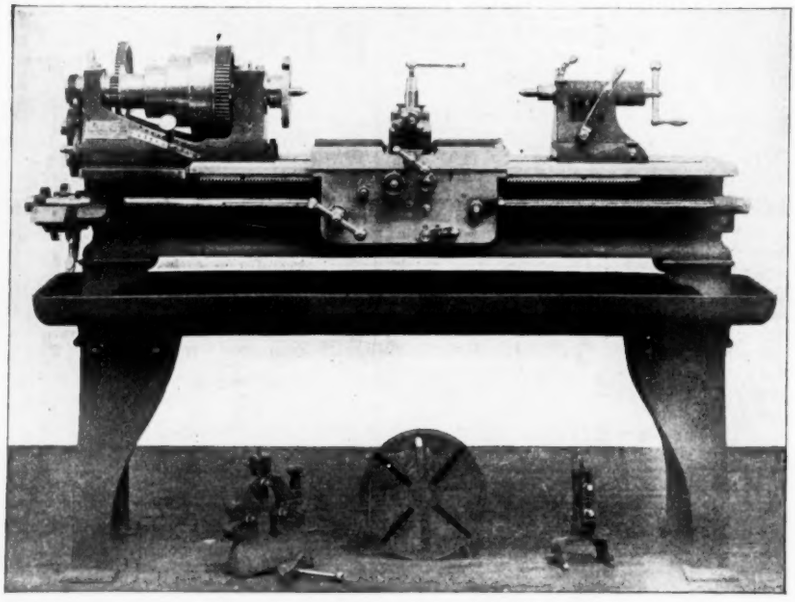

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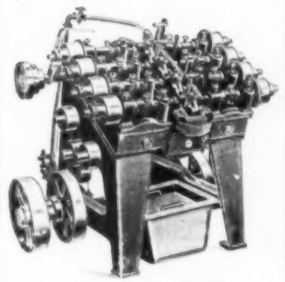

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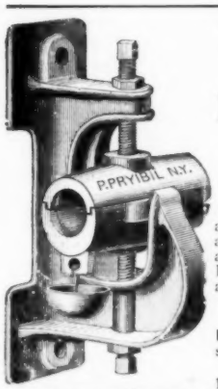

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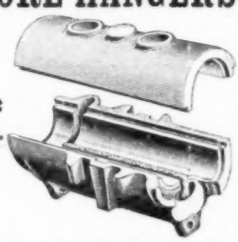

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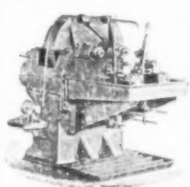

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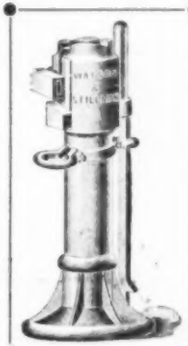

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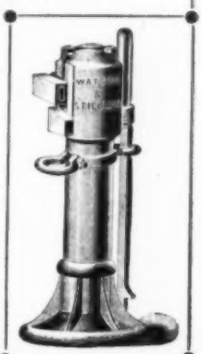

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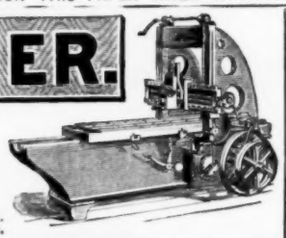

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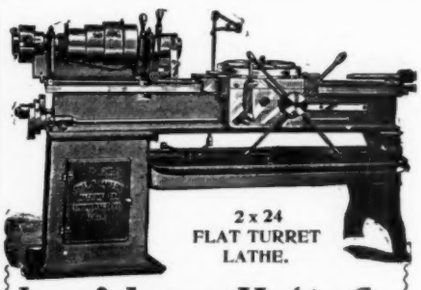

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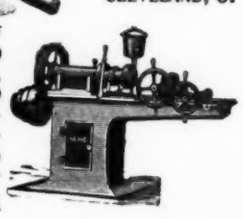

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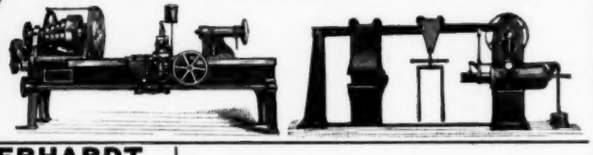

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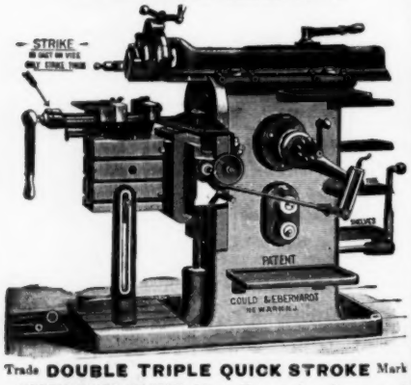

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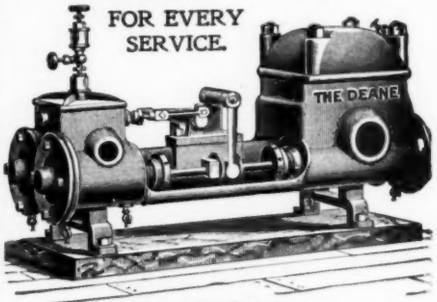

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Machine for Tapping Water Mains.

The machine shown in the half-tone herewith we have no doubt will be of interest to many of our readers, although it is not entirely new, except that it is larger than any heretofore shown. The term "tapping" as here used is not, of course, in the machinist's sense, and has nothing to do with cutting screw threads, but merely means cutting a hole in a main pipe and making a secure connection for a branch or outlet. The necessity of an apparatus by which such connections may be made to a water main without shutting off the pressure must be evident to everyone.

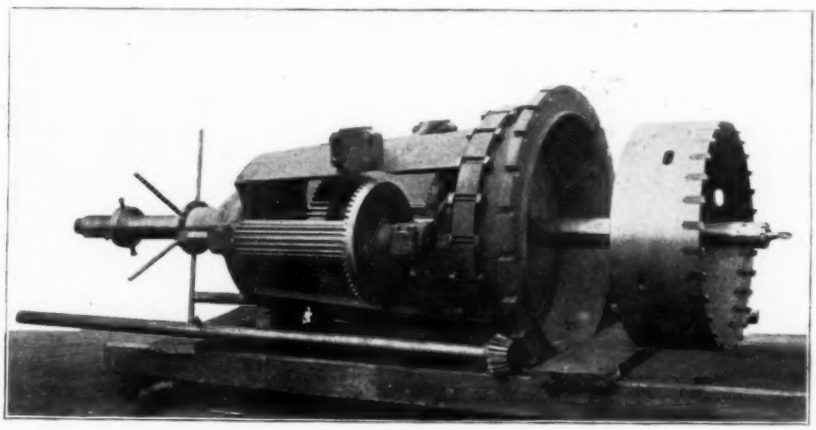
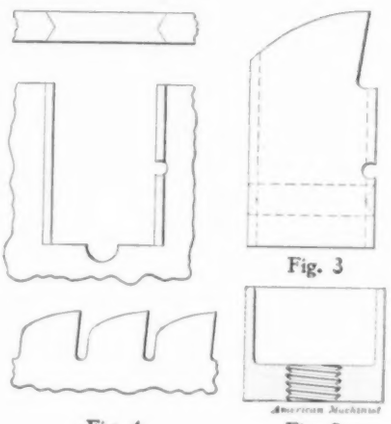


Fig. 1. MACHINE FOR TAPPING WATER MAINS.

The operation is a much simpler one than might at first thought be supposed. The first thing is to securely and permanently fasten a gate valve of the required diameter to the side of the pipe where it is to be tapped. Fig. 2 gives an idea of how this is done. As no hole is yet cut, the gate valve is wide open. The "tapping" apparatus is then bolted to the outer flange of the gate valve, the cutter projecting into the interior of it. Power is applied to the cutter, causing it to rotate, and it is fed along until it begins to cut the pipe, and the operation is continued until the piece is cut entirely out, leaving the required hole in the side of the pipe. As soon as the cutter begins to pierce the pipe, the water flows out, filling the interior of the gate valve shell, but not escaping beyond that. After the cutting is completed, the cutter is withdrawn, the piece cut out of the pipe remaining in the shell of the cutter and being withdrawn with it. The cutter is always withdrawn far enough to allow the gate to pass and close the valve. The apparatus may then be removed and the pipes connected and laid, and the water may then be turned on at any time by simply opening the gate valve.



CUTTING TOOLS FOR WATER MAINS.

The apparatus actually shown in the half-tone is the largest yet made for this purpose. It cuts a hole 36 inches diameter, and may, of course, be used upon mains of any diameter above that. As the work is usually done in a trench, and as the cutter must be driven by power, two vertical shafts are used, reaching up above the surface of the ground, and the power is taken by rope drive from a portable engine placed in the vicinity. One of the vertical driving shafts is seen lying in front of the machine. Two shafts are used for the purpose of balancing the strains upon the frame and spindle.

Many interesting jobs have already been done with this apparatus. A 12-inch connection was made with a 36-inch main 2 inches thick and under a heavy water pressure. Two 20-inch connections were made to a 20-inch main with the pipe 30 feet above the ground and the cuts at an angle of 45 degrees. The mains are usually considered stronger after they are cut than before, as they are reinforced by the sleeve.

The cutters used in this machine are interesting to the machinist, and, in fact, form the feature which first attracted our attention. For the large cutters the teeth are inserted, the shell being of steel or of cast bronze. The teeth, Fig. 3, are somewhat thicker than the shell and overhang it both inside and out. Each edge of the cutter has an angular groove with corresponding angles in the shell into which they fit. A small round pin at one side of the cutter holds it securely in place, and a semi-circular groove is cut in the shell under the end of it, to allow it to be driven out easily.

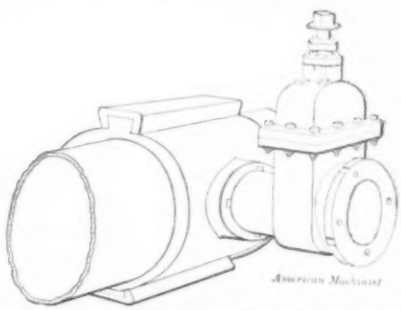


Fig. 2. CLAMPING GATE VALVE TO MAIN.

Cutters are made up to 8-inch diameter in a solid ring, the smaller sizes of these, Fig. 5, having a thick end with a thread to fit the end of the spindle. The teeth are made quite deep, Fig. 4, and by this provision it is made a simple matter to

harden the cutter without danger of cracking or springing the shell. The larger sizes of the solid shell cutters, up to, say, 8 inches diameter, are made straight through and without the thick closed end. These shells are fastened to a hub which is fitted to project into the back end an inch or more, and countersunk screws are inserted at the side.

The apparatus is made by Anthony P. Smith, Prudential Building, Newark, N. J., and to him we are indebted for photographs and information.

▲ ▲ ▲

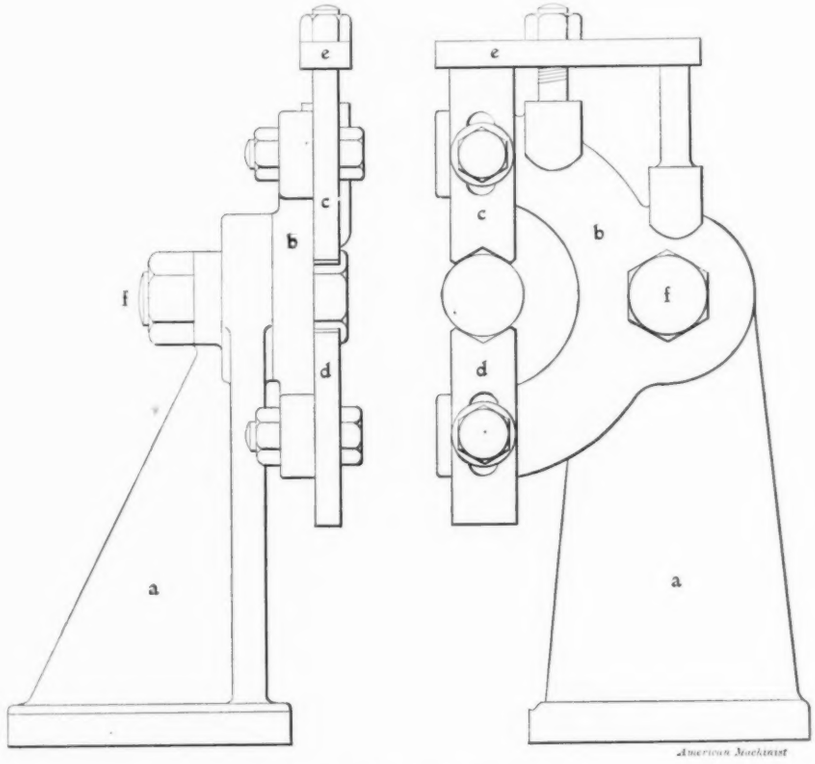
Center Rest for Grinding Machines.

BY C. O. GRIFFIN.

Having a good many pieces to grind which were of a length requiring a center rest to prevent chattering, I applied a rest of the pattern shown in the accompanying sketch, which has proven very satisfactory. The attachment was applied to a Landis machine, but is equally applicable to the Brown & Sharpe construction.

It will be seen to comprise a base or bracket *a*, bolted to the table of the machine and carrying a two-jawed casting *b*, embracing the work. This casting in turn carries two notched and slotted jaws of wood *c* and *d*, bolted to the casting, the upper one having a binding strap *e*, by which the jaws may be made to grip the work. The casting *b* is bolted to the bracket *a* by a bolt *f*. In operation the jaws are tightened on the work with the nut of bolt *f* loosened, after which bolt *f* is tightened and the adjustment is complete. The surface between the two castings *a* and *b* is so large that with a free fitting nut on bolt *f*, slightly oiled if necessary, there is no tendency for the casting *b* to shift and spring the work when the bolt is tightened. The jaws may therefore be made to give the work a positive grip, in which condition they are far more effective in preventing vibration, and permit a much heavier cut to be taken than will a mere contact, which is all that some of the corresponding attachments provide. This grip also enables advantage to be taken of the elasticity of the wood jaws, as they may be tightened to a degree which will allow several passes to be made with the wheel across the work without the jaws becoming loose and requiring to be adjusted again. The wood jaws should not slide in grooves, but should lie against a plane face on their casting, and should easily swivel around their bolts to enable fair contact with the work to be made at all four points. After the jaws are once set to a given piece of work, further adjustment as the work grows smaller is usually made by simply tightening the binding strap and without loosening the binding bolts for the jaws—the bolt for the upper jaw not being tightened enough to interfere with this. Bolt *f* is, of course, loosened at each adjustment of the jaws.

A stationary attachment like this one is preferable in some classes of work to those which travel over the work with the wheel. In my own case, the pieces to be ground were enlarged for about a foot at one end, and a rest which traveled with the wheel could not be used without constant resetting; whereas the rest here shown is located once for all when the work is put in the machine, and is then left undisturbed, except for occasional tightening of the jaws. In the case of long, slender reamers, too, the traveling rest gets in trouble with the teeth of the reamer; whereas a stationary rest may be set at the neck at the end of the flutes, and be used there for the whole process of grinding the reamer. In the case of long taper pieces which have occasionally to be ground, the traveling rest is obviously unsuitable, while the stationary rest may be used as successfully as with straight pieces.



CENTER REST FOR GRINDER.

From all points of view, I think this rest an improvement over any which I have seen, although the feature of being able to give the work a positive grip without possibility of springing it is the one of most value.

The tightening nuts should by rights be fitted with permanent handles, which would make the adjustment a matter of but an instant and would add greatly to the convenience. In my own case, however, common nuts requiring a wrench were used, and that would doubtless be the plan followed with most home-made rests.

Marine Engineers in New Zealand.

We are indebted to A. R. Hislop, Secretary of the Marine Engineers' Association of New Zealand, for a copy of newly enacted regulations which form part of the "Shipping and Seaman's Act," and provide as follows regarding marine engineers:

On all steamships the engineers shall be rated as officers, under the designation of chief, second, third and fourth engineer, respectively, in accordance with their relative positions on board.

Section two hundred and forty-one of the principal Act is hereby amended by the addition of the following proviso, that is to say:

"Provided that in every case where such investigation relates to a steamship casualty, and it appears from the preliminary inquiry that any question may arise affecting the engine department or any person employed therein, at least one of the Assessors shall be a person holding a first-class engineer's certificate."

Every applicant for a third-class engineer's certificate shall, before being admitted to examination, satisfy the Minister that he is at least twenty years of age, and has worked as apprentice for at least five years in a workshop or shops where engines are manufactured or repaired, or where other work of a similar class is performed.

Provided that the Minister may exempt from examination any applicant

(1) Who, at the date of the coming into

operation of this Act, has sailed and served as engineer on board a steamship for a period of not less than twelve months; or

(2) Who is the holder of the degree of Bachelor of Science in Engineering, granted by the New Zealand University, or by any university which is recognized by the New Zealand University as entitling the holder to admission *ad eundem gradum;* or

(3) Who has worked for at least three years in a workshop as hereinbefore prescribed, and has also attended the engineering class for at least two years in any college affiliated to the New Zealand University, or in any university recognized by the New Zealand University as aforesaid.

The second and third paragraphs of section twenty-eight of the principal Act are hereby repealed, and in lieu thereof the following is substituted:

"Every foreign-going steamship or seagoing home-trade steamship shall have engineers according to the scale set forth in Schedule A hereto, and no such ship shall go to sea from any port in the colony unless the master thereof has obtained and possesses a valid certificate appropriate to the grade of master."

In all steamships registered not sooner than six months after the coming into operation of this Act, the owner thereof

(*a*) Shall make provision to the satisfaction of an Engineer-Surveyor for the adequate ventilation of the engineers' rooms, engine-room and stokehole; and also

(*b*) Shall provide for each engineer, up to at least three, a separate room which does not open direct from the engine-room, but has a separate entrance to the deck otherwise than through the engine-room.

If default is made in compliance with this section, the owner is liable to a penalty not exceeding twenty pounds, and to a further penalty not exceeding five pounds for every day after the first during which such default continues.

For the purposes of prosecutions under this section, service on the master or agents of the steamship shall be deemed service on the owner.

▲ ▲ ▲

The Sleepy Eye Rotary Engine.

Only a few days ago a story went the rounds of the daily press about a wonderful rotary engine, the inventor of which, living at Sleepy Eye, Minn., had sold all proprietary rights in the same to an English syndicate for $1,600,000. The "New York Times," with many other papers, published the matter as an item of well-authenticated news. A later version, also from the "New York Times" is as follows:

"Minnesota scientists seem inclined to doubt that the steam turbine invented by a resident of Sleepy Eye will justify all the big assertions that have been made in regard to its powers, and they say that if English capitalists have really given $1,600,000 for the patent rights they must be men of a nature so trustful and optimistic that their names and addresses will be in great demand wherever there is anybody with visionary ideas to exploit. Some of the inventor's talk is certainly very curious, and it makes far from obvious his knowledge of fundamental physical laws. He claims to use all the expansive power of steam in a machine so small that it can be placed in a child's willow chair, and to transmit the force of forty horses by means of a shaft that a fifth of that force would twist like a string."

Thus we see how two mistakes can be made about the same matter, the second one in attempting to correct the first. Our contemporary would no doubt be surprised to learn that there is no difficulty whatever in utilizing all the expansive power of steam in a machine even much smaller than that indicated, and that very small shafts will transmit 40 horse-power if only they run fast enough.

▲ ▲ ▲

Cycle Stampings.

"Stampings" used in a cycle sense is made to include all the parts produced by press-work from sheet metal, whether the operations required to make the pieces include actual "stamping" or not. In point of fact, the drop hammer is but little used in the manufacture of cycle stampings which are not in the main, in the strict shop sense of the term, stampings at all, but are press-work pure and simple, but "stampings" is the fully accepted term, in use in the largest establishments and universally adopted by the trade, and consequently must be recognized here.

Frame "joints" are not really in any sense "joints;" they are "joining pieces," and the most careful work of the cycle makers is exercised to prevent these joinings from acting as "joints," because the slightest looseness or working of the tubes in their seats in the joinings in which they are brazed would be a fatal fault. The "joints" are, if forged, made of solid drop forgings having the general outside shape of the finished joint; these are machined first in drill presses of the most powerful description to bore them out to mere shells of paper thickness, and then the outside is machined true with the holes by hollow milling, turning in the lathe and hand work on the vise and grinding wheel. All of this makes the forged joint a very expensive piece; which can be replaced in cycle construction by a very much cheaper member of sheet metal cut and formed to shape, except in case of the crank hanger, which is almost invariably made of a forging, its shape being such as to make its production from sheet metal by cutting and forming a very difficult matter, although I have seen crank hanger stampings which were very good indeed, and the efforts of inventors in this line are constantly appearing in the form of patents on variously pieced-up tubing crank-hangers, any of which are probably capable of good service if used in connection with reliable brazing. However valuable these probably good drawn and formed crank hangers may finally prove themselves to be, all of them which I have seen involve such a multiplicity of operations in manufacture as to bring their cost well up to that of the drop-forging construction of this member; some forms of stamped crank hangers involve successive hot-drawing steps and other expensive and unusual processes, and taken altogether the forged and stamped crank hangers seem to have about equal advantages in manufacturing cost with a strong popular prejudice in favor of the drop forging, which seems quite likely to remain in use for a long time, although the advocates of stamped work claim a decided superiority for the sheet metal construction, which is used exclusively, I believe, by some makers. But all the other joints of the frame, and even the fork-post, may be made in stampings; the stamped fork-post tube is, like the stamped crank hanger, an undecided experiment in point of economy.

The Western Wheel, which is one of the four largest American cycle-making concerns, has from the first been a very large user of stampings. Their first stamped work was imported from Germany, and the first American order for cycle stampings was given by the Western Wheel to H. S. Bancroft, now salesman for the H. A. Matthews Stamping Works, Seymour, Conn., in 1890. From that time to this the use of cycle stampings has constantly increased, until it has now become an important manufacture, employing a considerable number of specially trained toolmakers, and hence of distinct interest to readers of the "American Machinist." The Western Wheel is perhaps the most pronounced in its views in regard to the use of stampings of any of our makers, all of whom, however, use stampings to some extent; one first-class concern which advertises "forgings used exclusively" has, to my knowledge, placed an order for hundreds of thousands of stampings for its 1897 output, and it goes without saying that all cycles made contain a large number of pieces of stamped work.

In regard to the relative merits of forgings and stampings, advocates of the latter claim that sheet steel is a better and stronger material than the thoroughly annealed and but slightly compressed drop forgings can possibly be, and the stampings can be put in such form as to give better resistance at points of stress, and a more uniformly correct distribution of metal than is possible with forgings. But the stampings have the generic fault of at least one open line of juncture, where the shell simply meets without any

adhesion whatever, and brazing must be depended upon to overcome this difficulty, and experience shows that such dependence is seldom misplaced. To turn from the theoretical to the practical aspects of the question, we find the use of stampings steadily increasing, and in no case within my knowledge has a maker returned to the use of forgings in a place where the stamping has once been adopted.

The makers of stampings are generally quite disposed to keep their operations close, and to withhold all description of their tools and methods from the public. The Matthews Company, of Seymour, Conn., however, permitted a close inspection of their entire establishment, with the exception of their automatic machines for grinding ball cups, and I can say with certainty that each separate piece of stamped work is so entirely a new job, different from any other, that little or nothing could be gained from a close description of the tools used for any one piece, which would greatly aid a novice in the production of a different piece of stamped work. I therefore give here but one set of stamping tools with an engraving of the finished pieces which they produce, which is patented. An essential feature of this set of tools is the use of loose arbors or mandrels for supporting and shaping the inside of stampings which close to form a complete circle at some points. These arbors are not fastened to the dies in any manner; they are simply either held to place by the hand holding one end, while the other end lies on or in the partly formed work resting in the die. After the loose arbor is so placed, the press slide makes its stroke, bringing the top die down on the work. In Fig. 1 the workman in the foreground is shown forming the piece sketched in Fig. 2, holding a loose arbor in each hand in the closing die 7, Fig. 6, where the loose arbors are shown lying on the dies with which they are used. The inexperienced tool-maker called upon to produce forming dies may find it to his advantage to bear in mind this use of loose pieces, held in the hand, yet forming a co-acting part of the dies fixed in the press. Such loose pieces are much used, and work perfectly well.

Referring to Fig. 2, it is quite obvious that the frame members *C* and *D* are much better supported at *a a* than would be the case if the reinforcement terminated at those points, and it is claimed that this enables the frame to better resist such stresses as result from bend in collisions. Such shapes as are shown in Fig. 2 are costly if made from forgings, but are very readily produced by stamping. The open junctures in the stamping shown in Fig. 2 are at *E* and *F*, and do not weaken the piece at all if the brazing is good, and no cycle frame construction with either forgings or stampings can be relied upon with faulty brazing.

The Matthews Company began making cycle stampings January 1, 1895, with Mr. Bancroft, previously mentioned, as salesman, and Mr. Cornforth, under whose

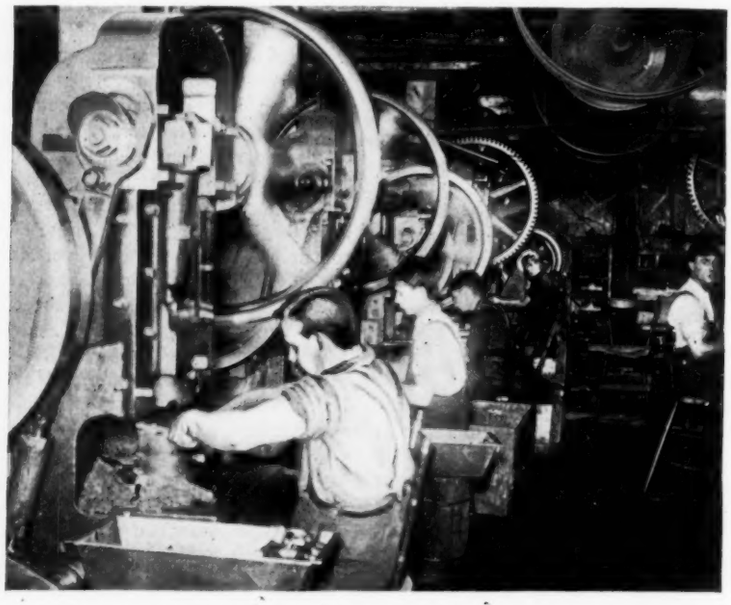


Fig. 1. USING LOOSE ARBORS, MATTHEWS SHOPS. FORMING DIES FOR OPERATION No. 7 IN PRESS.

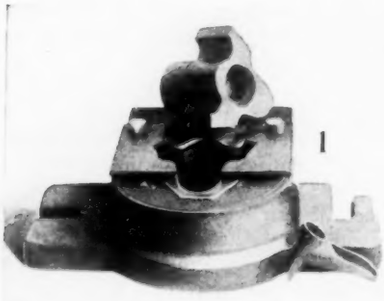


Fig. 3. CUTTING DIE FOR BLANK No. 2.

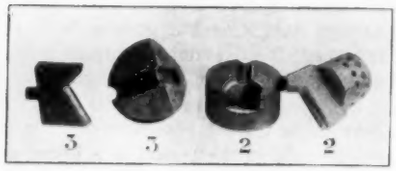


Fig. 4. FORMING DIES FOR OPERATIONS 2 AND 3 ON PIECE SHOWN IN Fig. 2.

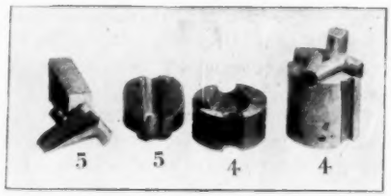


Fig. 5. FORMING DIES FOR OPERATIONS 4 AND 5.

Fig. 6. FORMING DIES FOR OPERATIONS 6 AND 7.

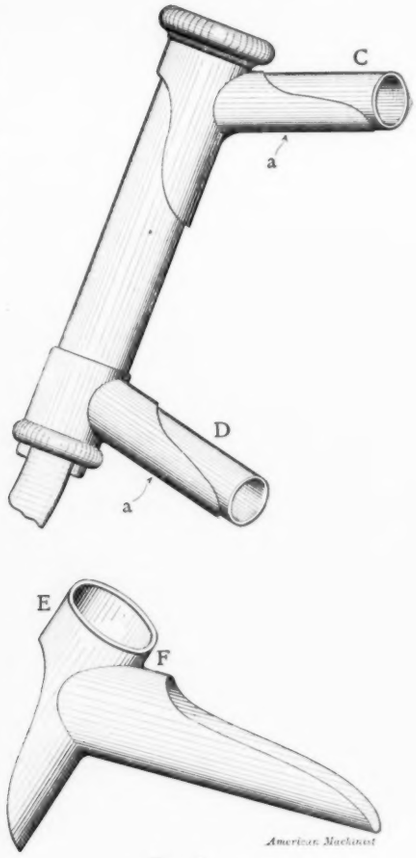


Fig. 2

supervision the tools for those first American cycle stampings referred to were made, as master tool-maker.

The Matthews shop is located on the west bank of the picturesque and rapid Naugatuck River, at the foot of a high rocky hill, surrounded by trees, and approached from the right by a stone bridge over Little River, which supplies a hundred horse-power for nine months in the year and almost none at all during the three summer months, through which the works are driven by steam.

Speaking generally, the operations on stampings may be divided into cutting, forming (including the needful repeated annealing), trimming, hardening, grinding and plating.

Fig. 3 shows the punch and die for the first operation, cutting the blank, to make the piece shown in Fig. 2. The finished piece is shown at the right hand in front of the die-block. Fig. 4 shows the dies for forming operations 2 and 3. Fig. 5 shows the forming dies for operations 4 and 5, and Fig. 6 shows the dies for operations 6 and 7, the dies for the seventh operation being in use in the press in the foreground of Fig. 1.

It is the fixed rule in the Matthews shop to anneal after each forming operation. Some of this annealing is done in the Brown & Sharpe furnace, using the iron pipe annealing tubes with ends screwed on, shown in Fig. 7, where several

Fig. 7. TAKING WORK OUT OF ANNEALING TUBES.

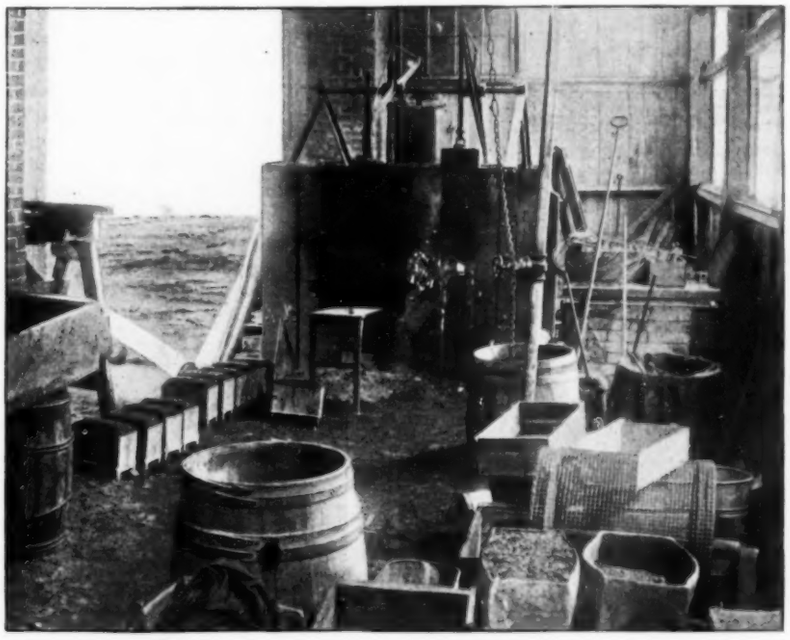


Fig. 8. ANNEALING AND CASE-HARDENING ROOM, BROWN & SHARPE FURNACE.

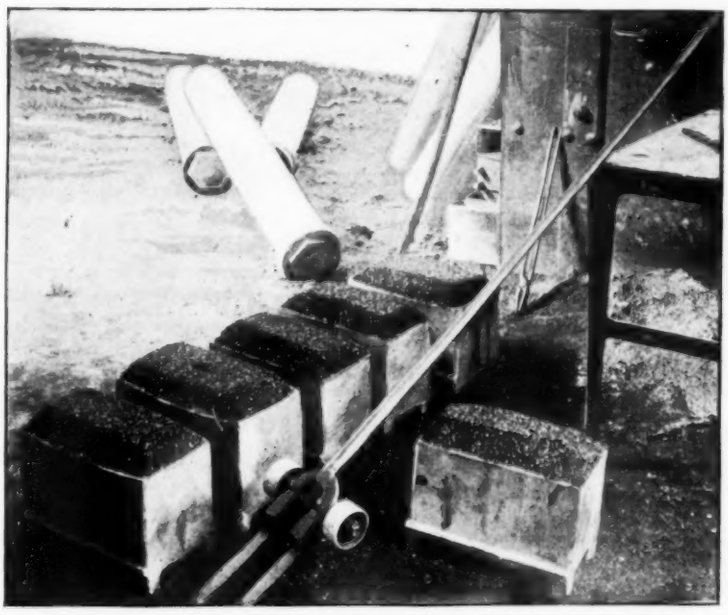


Fig. 9. HARDENING BOXES PACKED, AND FURNACE TROLLEY USED FOR PLACING PACKING BOXES IN THE FURNACE.

case-hardening boxes of cast iron also appear in the background. The pieces to be annealed are packed in the tubes with iron chips, hematite ore or charcoal, care being taken that the packing is close enough to insure keeping the work from being bent by its own weight while red hot in the anneal, and the cap is screwed on after the tube is filled full. The tube is then carefully heated to a full red and allowed to cool slowly until perfectly cold before opening, as in Fig. 7, where a tube is shown just emptied. These annealing tubes are of common iron pipe about 6 inches diameter, threaded for caps at each end. The greater part of the Matthews annealing is done at another establishment, with different apparatus (which I did not see), capable of handling 40 barrels of work at one operation.

Fig. 8 is a general view in the furnace room, showing riddles and packing boxes, and so on; and Fig. 9 is another view in the same room, showing boxes full of work packed in bone charcoal ready for case-hardening, and the long-handled trolley used for placing the packed boxes in the furnace and drawing them out again, the boxes standing on four short legs to permit the forks of the trolley to go under the boxes and lift them up. The work is packed for case-hardening in the usual manner, bone charcoal being used exclusively.

"Trimming" here means squaring the ends of the stampings in some form of

lathe after they are completely formed. This operation consists of chucking the pieces one at a time in some form of chuck having jaws shaped to fit the work, and then squaring the projecting end with some form of steel cutting tool, no grinding operation being used on the soft work. I suppose the ends of the hardened work, ball cups and so on are ground true after hardening, as a matter of course.

Fig. 10 shows a special trimming lathe, designed by Mr. Cornforth, which is extremely rapid in operation. A wide flat tool is bolted to the upper part of the cast-iron sliding tool carrier *C*, which is moved forward and back by the hand lever *L* to stops in each direction. The chuck is a Cushman scroll, and is both opened and closed by the movement of the tool carrier *C*, which, when drawn to the extreme left, moves the collar fork *A* so far to the left, carrying the collar *E*, sliding on the lathe spindle between the front head-stock bearing and the chuck, that the crank arm *B*, secured to one of the chuck screws, is moved far enough by a link pivoted to both *E* and *B* to open the jaws of the chuck and permit the trimmed work to drop out. A slotted bracket *T*, screwed to the upper side of *L*, takes the bent end of the rod *R*, which is bolted at its upper end to the belt-shipped handle *S*, so that when *L* is moved to the extreme left, the driving belt will be carried on to the loose pulley on the lathe countershaft, and so stop the lathe spindle as well as open the chuck jaws and permit the finished work to drop out. The workman has the next piece in his fingers, as shown in the picture, and puts it in place in the chuck jaws and then pulls the lever *L* towards him to the right, which pushes the tool carrier towards the work and at the same time moves *A*, *E* and *B* all to the right, and so tightens up the chuck jaws on the new piece. This chuck-tightening operation continues until the steeply inclined face of the latch *R* is lifted up against the action of the spring *S* by the resistance of the tightening of the chuck jaws, and at the same moment the belt begins to drive the lathe spindle again and the cutter is brought against the work and trims it in a small fraction of a second, ready to begin over again by moving the lever to the left. This machine is incredibly rapid in operation. I did not time it, but think it can easily trim 8,000 to 10,000 pieces per day. The machine is shown in Fig. 10, trimming ball cups, and keeping four special lathes, fitted with draw-back collets, very busy to keep up with it, although these four lathes merely take off the very small inside and outside burr formed in trimming the cups, by the application of hand tools and emery cloth. This burr is extremely small, as the trimming cutter is kept very sharp, but it is large enough to destroy the cup-grinding wheels if left on the cups until after they are hardened.

Fig. 11 is a general view in the plating room, showing, however, but a small portion of this interior, as the light did not permit an entire view.

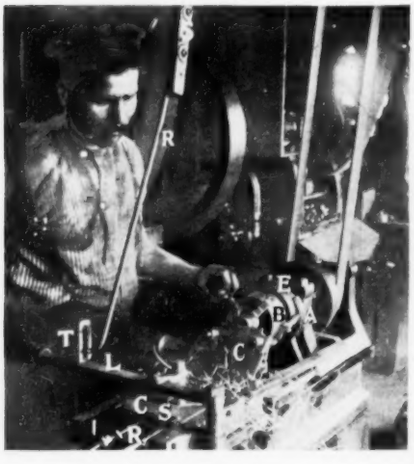


Fig. 10. SPECIAL TRIMMING LATHE, BY CORNFORTH.

Fig. 11. PLATING ROOM.

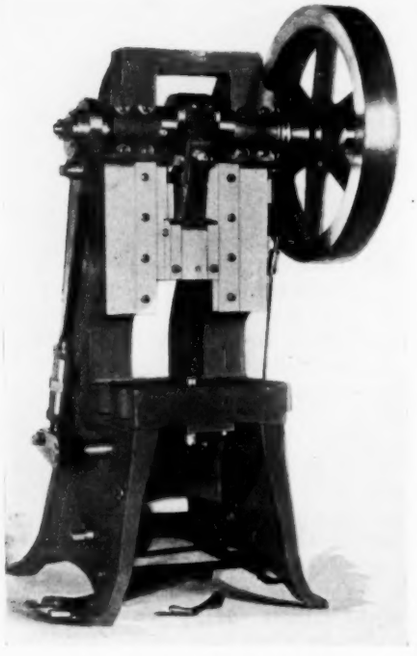


Fig. 12. WHEELER PRESS.

As is well known to users of power presses, nothing is more destructive to the common forms of adjustable connecting rods used between the crank and the press slide, than pressing or forming operations, and it may be worth while to give a description of the press which has been found satisfactory for the work here. It is made by Frank Wheeler & Sons, Meriden, Conn.

The general form of the Wheeler "open-back" press with bottom "knock-out" action is well shown in Fig. 12.

As shown in Fig. 13, the Wheeler rod *F* is mortised at the crank end to take a screw-adjusted crank-pin box sliding at an angle of about 30 degrees to the axis of the rod, so as to lengthen or shorten the virtual length of the rod by moving the crank-pin box in this mortise in the top end of the rod, while at the same time the flat pressure-sustaining under side of the box is kept in full contact with the full surface of the under side of the mortise in which it slides for adjustment. This

full face, flat contact surface enables the adjustment to stand up under repeated pressures, and the angular position of the adjusting screw relieves it of excessive strain. The punches are very easily shoved into dies by the use of the adjustment alone, which is a very convenient feature, as the tool-maker can perform the operation unaided, without calling in or depending upon a helper. The sliding box is made in two pieces, one with a threaded sleeve on which the other part is screwed up hard, the whole being secured on the crank-wrist by an outside

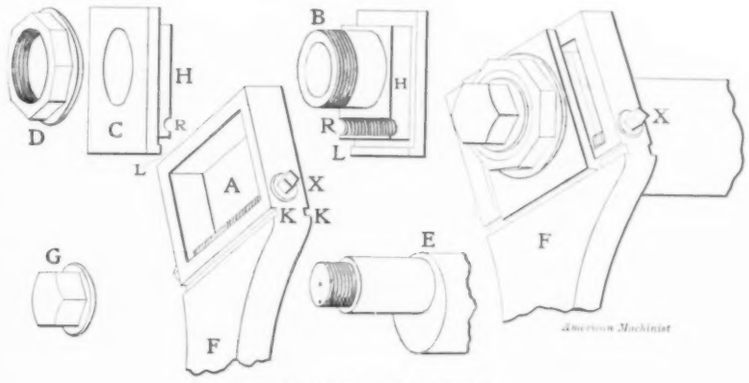


Fig. 13. DETAILS OF PRESS.

nut. This rod, as applied to the open-back press, is of slightly different construction, but retains the same distinctive features. When the nut *D*, Fig. 13, is tightened, the flanges of the box bear hard on the sides of the rod; when *D* is slack, turning the screw *X* adjusts the rod length to any required degree of exactness.

Much more might be said in regard to the Matthews practice in making cycle fittings, but enough has here been given to afford a general idea of this shop and its methods, and, as stated at the outset, each separate job of cycle stamping tools is so much a special example that little more of value than this general information can be given.

HUGH DOLNAR.

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The death of Mr. J. M. Breckenridge is reported from Meriden, Conn. Mr. Breckenridge at the time of his death was eighty-seven years old, and had invented many improvements in clocks and clock-making machinery, including the method and tools for punching holes in brass frames (instead of drilling) and the wire bell. It is said that he worked at the bench until last May.

▲ ▲ ▲

In connection with the diagram and formula for proportions of arms of wheels, published in our issue of December 3d, we should have stated that these were devised and arranged by Mr. Geo. E. Ugland, formerly of St. Louis, but now of Purdue University, Lafayette, Ind.

Valuation of Manufactories.

BY OBERLIN SMITH.

In seeking to ascertain the value of a manufacturing plant, the most obvious solution of the problem involved is a citation of the trite but somewhat flippant remark, "It is worth what it will bring." An antithetical statement to this is perhaps the equally familiar one, "'Tis worth what it cost." There is, undoubtedly, some truth in both of these propositions, but either of them may, under certain conditions, be decidedly misleading, especially the last one.

Applied to property in general, a valuation based upon what it will bring is, in the long run, a correct one; but this is a rule that will not always hold good for a short run—so to speak. This is notably the case with property which is, from some commercial cause, temporarily unproductive, and which is disposed of by a forced sale—perhaps at a very unpropitious time, as during a financial panic. In other cases a property may be sacrificed by being sold too hurriedly, or at an inaccessible place, or without proper advertising. The disadvantage of not duly setting forth the negotiability of goods and chattels is well illustrated by the old story of the boy who started out in the morning on horseback to market a bag of corn, but reported to his father in the evening that it could not be sold. When asked if he could find no customer, he replied that nobody seemed to take any interest in the matter, except a party of men who asked what he had in his bag, whom he told it was none of their condemned business.

When we consider the intrinsic value of staple and absolutely useful articles of barter and traffic, as wheat, coal, cloth and gold, we find (if we eliminate merely temporary and speculative values brought on by the machinations of "cornerers of the market," etc.) that they do not vary a great deal from time to time, when measured by the universal standard of the world's barter, labor, except as their values are gradually changed by the general law of demand and supply, and by new discoveries and inventions which facilitate cheap production. These changes, however, occur gradually, and never in the form of a catastrophe. Such property always being in demand, to a large extent, to supply the imperative wants of mankind has, disregarding mere speculation as above mentioned, a very definite value in the markets of the world, which always may be measured in the terms of the first proposition; that is to say, it is worth what it will bring—when sold with proper publicity.

In the case of buildings, machinery and other manufacturing plant, much of which is not of intrinsic value for the maintenance, comfort and pleasure of the race, as is wheat and cloth, a new element of value appears, viz., its productiveness or innate power of creating things of value, as, for instance, in sowing, reaping, threshing and grinding the wheat (a modern wheat-farm can logically be considered analogous to the grist mill and other manufactories), or in transforming the cotton into cloth or garments, etc. In considering, therefore, the real value of property of this kind we must regard it, to a great extent at least, as a special tool, which is useful only so long as it is capable of the economical production of articles which are, and are likely to remain, in demand as staples, and so long, moreover, as it has sufficient capital and a sufficiently able management to compete with its rivals and to always be able to sell a sufficient volume of its products to keep it profitably running.

Among the necessary factors of success with any factory which comes under the competitive conditions incident to modern commercial life, are a proper location and the most improved processes and methods for cheap production. Certain exceptions to this proposition may be found in cases where manufacturers are fortunate enough to possess a monopoly of their particular line of business, either through the holding of protecting patents or by the possession of specialized knowledge which their would-be rivals have not yet become acquainted with.

Taking for granted the presence of the above-named favorable general conditions, the owner or other appraiser of a manufacturing property who wishes, at any rate at the beginning of each fiscal year, to ascertain what it is really worth, must face a number of rather knotty problems, some of which must be solved after all by guesswork, and for this the best judgment possible is of course required. The first fact becoming apparent in the general consideration of this matter of valuation is the seeming presence of two different kinds of value, which, for want of better names, may be termed the commercial and the mechanical. In considering the mechanical value of specialized property (this term "specialized" being used to distinguish it from staple articles, which anybody and everybody can and must use), the principles concerning which will be

specified more in detail later on, it will be found that such value must be subordinated in the long run to the commercial value, which, of course, is governed upon an average, as before intimated, by what it will bring. Such salable value, leaving out of the question sudden panics, forced sales, etc., is obviously in its turn, governed by its innate average powers of profit earning. The real commercial value of any property may therefore properly be considered as a sum upon which the average net profits which it has rendered for a term of years have been, and are likely to be in the future, some five or six per cent. annually of the sum in question. The reason why the three or four per cent. profit which is acceptable in the case of investments backed by the national credit of great governments is not sufficient in the case of manufactories is obvious—being simply because the uncertainty in regard to their future stability is almost infinitely greater than in the case of the governmental securities mentioned.

It soon becomes evident to our appraiser, however, that a year or two of panic, and its consequent commercial depression, may temporarily decrease the profits of a usually prosperous manufactory to nothing, or to a minus quantity, and that the factory in question, if put to an immediate sale at auction, would not bring one-tenth of its former and its supposable value. Knowing that, in all probability, a year or two of the hoped-for commercial prosperity which is almost absolutely sure to return will put the concern upon its old basis, it obviously is not fair to depreciate the inventory during these years of depression, some ninety per cent. perhaps, to conform to the auction value of the property.

If in average good times a business gradually ceases to pay profits, without any apparently remediable cause, the real value of the plant will, of course, rapidly depreciate until it represents merely the value of such part of the property as can easily be turned to other profitable and well-known uses—the more specialized parts of the same being almost absolutely valueless, except for old material.

In some instances such a cessation of profits as has just been cited may, to a far-sighted manager, seem to be really only temporary, and due to causes which can be remedied by a hoped-for increase of capital, and by a lapse of sufficient time to acquire and achieve improved tools and methods for cheapening production. In such cases the property will for a time, perhaps even for a term of years, become of low market value; and if it is a corporation, its stock will become and will remain almost unsalable. This is especially the case if the temporary mechanical drawbacks which may exist happen to be contemporaneous with a prolonged commercial depresion, accompanied with a lack of sufficient volume of business to fully occupy the plant, as has been the case with so many thousands of manufacturing concerns throughout this country during the last three or four years.

Probably in cases where the appraiser has good reason to consider the depression only temporary, the best plan is to depreciate the inventory to the lowest fair mechanical valuation, and then to allow the difference between that sum and the market value of the property to remain as a melancholy but involuntary factor of commercial discredit, until the advent of more prosperous days.

Should such a valuation unfortunately wipe out, and perhaps reduce to a minus quantity, any "surplus" or "reserve" account which might have before existed upon the books of the concern, so that the net worth (if it is a corporation) becomes less than the issued capital stock, then a "deficit" account must be opened, as converse to the former surplus. To wipe out, in its turn, this deficit will then be a noble aspiration for all concerned in the management. In general, it may be said that the best governor or balance-wheel to regulate all such discrepancies as we have been considering, is a big enough surplus account to keep the stock of the concern above par, even though the plant itself may be considerably depreciated, the owners thus having a system of self-insurance against temporary disasters.

It is obvious that the strictly commercial aspect of this question is and necessarily must be governed by competitive overproduction, by panics, by bankruptcy of debtors, by alteration of tariff laws, by changing conditions and locations of the great highways of traffic (as canals and railroads), by the growth or decadence of cities, by the advent of new discoveries and inventions, by the formation of syndicates of speculators, by the institution of monopolies, by the decisions of courts, by epidemics, by wars and rumors of wars, and by catastrophes of Nature, such as earthquakes and cyclones, none of which factors even the best human foresight can provide for, and all of which must be counted among the risks of business life, as elements which necessarily make an inventory of property an uncertain quantity in its very nature. Disregarding, therefore, the more lottery-like aspect of the question, and viewing it strictly from an engineering standpoint, it will be well to consider more particularly the most correct methods of obtaining the mechanical values of the various machines and other articles known as manufacturing plant.

In certain papers entitled, respectively, "Inventory Valuation of Machinery Plant" and "Intrinsic Value of Special Tools," presented by me before the American Society of Mechanical Engineers at two of its meetings in 1886, the principles governing inventory keeping were set forth in more detail than can here be specified. A broad distinction was therein made between general tools, such as real estate, boilers, engines, shafting, lathes, planers, drill-presses, etc., which, as a rule, can be wholly or partially turned to other uses, if necessary, than those for which they were built and equipped, on the one hand; and special tools, such as working-drawings, patterns, jigs, cradles, templets, gages and specialized machines fitted for certain operations upon particular pieces, on the other hand.

Although the hypothetical proposition mentioned at the beginning of this article in regard to a thing being worth what it costs may more nearly apply to all this last-named class of property than to staple articles, yet it is rarely a safe scheme to work by unconditionally. A general rule for inventory taking may be quoted from my first-mentioned paper above cited, as follows: "Rate all property that it would be desirable to reproduce, were it destroyed to-day, at the net cost of such reproduction in its existing locality, minus its estimated damage by wear-and-tear. Rate partially obsolete articles the same way, but minus also a percentage of their apparent value equal to their estimated percentage of obsoleteness, or of improbability of usefulness. Rate wholly obsolete articles at nothing."

The plan advocated by some writers upon this subject of depreciating special tools from the beginning, say fifty per cent. or so, because they are special tools, is not a logical one, commercially considered. Thus a new company might immediately invest a large part of its subscribed capital in special plant and be obliged in a month to say to its stockholders that their property is worth only 50 cents on the dollar—for the inventory says so. In another case a prospectively profitable canal, just dug at great expense, might be valued at much less than cost because it was a specialized piece of property, not easily to be utilized in case of a desire to turn it into a railway embankment.

An important part of the appraiser's work, requiring keen and experienced judgment, is to decide the amount of depreciation due to wear-and-tear upon any given article. A still more important part is to decide the degree in which its usefulness or productive power is lessened by its having become partially or wholly obsolete. Into this latter decision the commercial element always enters to a considerable degree, inasmuch as the appraiser must determine various possibilities regarding the continuance of old processes versus their possible modification or abolition.

With general tools, the amount of obsoleteness is usually dependent upon their degree of unproductiveness in regard to quantity or quality of work, or both. Thus a plot of land may be inaccessible from waterways or railways, although originally conveniently situated according to methods of transportation then prevalent.

A shop building may be too dark and low-ceilinged to suit modern methods, and

perhaps also of an inconvenient shape. An engine may cut off steam too late in its stroke, or a lathe may be inconvenient to handle or be incapable of taking a sufficiently heavy cut, for either of them to be in touch with the most recently improved modern machinery. All of these pieces of property, land, shop, engine and lathe, may have been of excellent quality originally; and the three last-mentioned may have been kept in such good condition as to have but little wear-and-tear depreciation. The appraiser, nevertheless, may find himself in dire perplexity as to whether he shall mark down these things with a heavy hand because of the near approach of a time when they must be abandoned altogether—when there must be new shops, in a better locality, filled with strictly modern machinery. If he considers this time near at hand he must rate everything which will need to be replaced, at the price only that it would probably bring if it was to be used for other purposes.

The obsoleteness of special tools is based upon a somewhat different principle, although their general productiveness must, of course, be considered. It is usually taken for granted, however, that if a foundry pattern, or a jig, or a gage, is worth having at all, it must be made and maintained so that it may do its work perfectly enough to allow of the highest speed of production possible. If the article it helps to produce is materially changed in design, the tool may suddenly become entirely obsolete. If this does not occur, a partial obsoleteness, measured by a growing infrequency of use, may come from some changing fashion or outside competition lessening the sale of the article in question. The appraiser must therefore be prepared at all times to most unmercifully "cut and slash" among his valuations.

Recurring to the matter of wear-and-tear, it may be said that special tools are not much affected by this form of depreciation, for the reason above-mentioned, viz., that to do their work at all, the tone of their quality must be kept up to concert pitch, so to speak—and also because the matter of appearance, and its deterioration by wear, do not constitute elements of value, more or less, as they do in many staple articles.

With general tools, as before intimated, the question of wear-and-tear is a very important one—not only in regard to efficiency, but also appearance. We find, therefore, that it is the common custom to depreciate the buildings and machinery of manufactories all the way from, say, five to fifteen per cent. per annum—each new percentage being based upon the last reduced price. Those owners who adopt a large ratio of reduction as, e. g., ten per cent. for standard machine tools, must either mark them below real value after the first or second year, or else allow them to get into such very bad order as to render them unprofitable tools to use.

A better plan, as it seems to me, is to depreciate such things as buildings, shafting, machine tools, etc., only about five per cent for wear-and-tear proper, and then to keep them in first-class order all the time, renewing certain parts entirely when necessary. With such perishable articles as steam boilers and the like, a larger proportion should be deducted—probably never less than ten per cent. Such property as belting and cordage depreciates still more rapidly, and needs bringing down to about half cost at a rather early period of its career. It can then be kept at stationary figures indefinitely, with scattered-about renewals enough to keep up the average value. Meanwhile, a very sharp eye must be kept upon everything, to watch for any depreciation due to partial obsoleteness.

After our appraiser has gotten through with his solving of the many material problems pertaining to the plant proper, having been obliged to guess at a number of conundrums, and to balance his conscience occasionally between what he thinks he would tell a tax assessor and an insurance adjuster, respectively, were he called upon to express his views, he perhaps finds himself considering the more strictly mercantile assets of the business. With book accounts against good debtors, he, of course, has plain sailing; but with doubtful ones he must guess at some probable value, much in the same way as he estimates the proportion of obsoleteness in a special tool.

Another class of mercantile valuation pertains to what may be termed "vanishing assets"—values which decrease regularly and positively until they expire entirely. Prominent among these are patents and paid-up insurance policies—the decrease each year being usually the initial value divided by the term of life, in years. The intrinsic value of patents is usually a very uncertain matter. Unless they are producing a definite income, a safe valuation is merely the sums which they have cost to procure. Many of them are worth even less.

In conclusion, it may be said that an appraiser of the multitudinous articles generally comprised in a manufacturing property, be he the owner, the manager merely, or an outside expert, should perform his difficult and delicate duties with a leaning, if anything, toward a pessimistic rather than an optimistic spirit. In other words, he should be sure to rate things, on an average, a little too low rather than too high—for nothing is more dangerous, should financial trouble come, than for the owners of a business to find that they have not got what they thought they had. Among the many wrecks which strew the shores of our stormy commercial seas, not a few apparently staunch craft have come to grief upon the jagged rock of an inflated inventory.

A New Steel Hanger for Shafting.

The half-tone herewith shows, so clearly that little explanation is required, a rather novel hanger for shafting. The main part of the hanger consists of a continuous strip of oval steel, extending over the top and down the sides, with the ends rounded and threaded for the nuts which carry the box. This construction allows the hanger to be made of any required drop, that shown in the cut being comparatively long. The sizes of oval section thus far employed are from $\frac{5}{8} \times 1\frac{1}{4}$ inches to 1 x 2 inches. The shoes which clamp the hanger to the beam may be as far apart as possible and close to the descending member on each side, or they may be placed nearer together if necessary. A set screw extends out horizontally from a lug on

STEEL HANGER.

each clamping shoe to the inside of each suspension arm, and by the manipulation of these screws the lateral adjustment of the hanger is easily accomplished. The vertical adjustment is also obviously a simple matter, by means of the nuts on the vertical threaded portion of the suspending arm. The boxes have a ball-bearing which is machined, instead of trusting, as is the common practice, to the molder to make it all right. They are made either plain or self-oiling, and are interchangeable in the same hanger for different sizes of shafting. The hanger, it will be seen, combines strength with lightness. It might be suggested that it is deficient in lateral rigidity, but by actual tests it is demonstrated that this objection is untenable. The hanger is made by J. B. Johnson, Gouverneur, N. Y.

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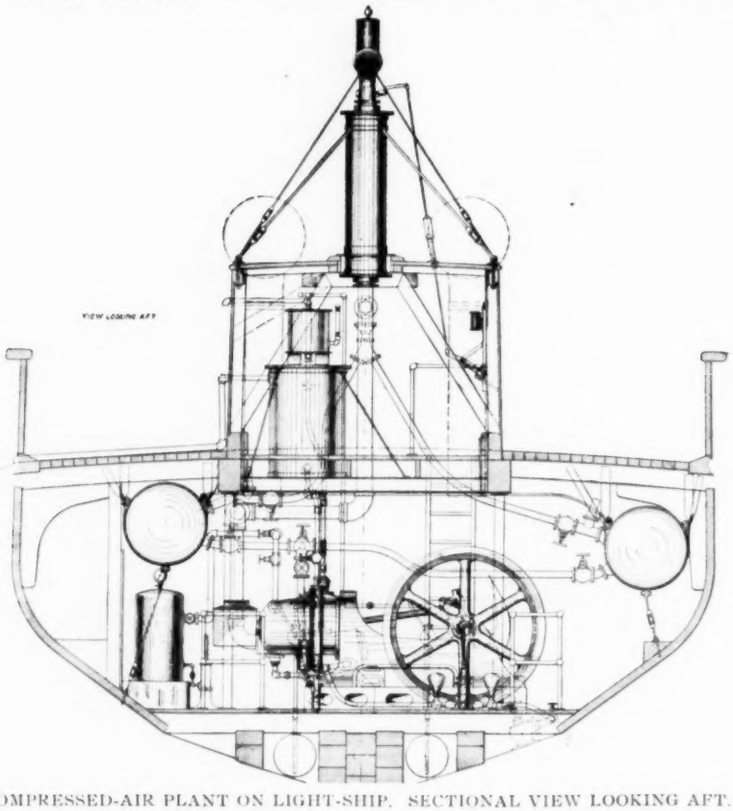
The Duke of Westminster has just completed on his estate a railroad of 15-inch gage. It is for conveying minerals chiefly, and it was desired to make it as inconspicuous as possible, and is so arranged as to be scarcely noticeable unless one is close to it.

A Light-Ship Compressed-Air Plant.

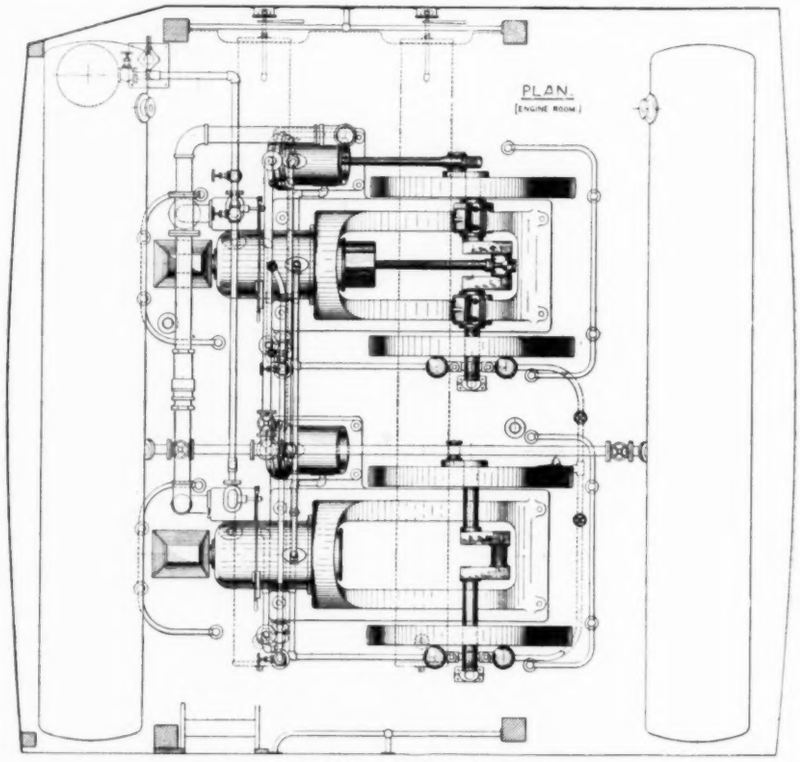
The audible fog signal is a very necessary part of the equipment of a light-ship. It is never more desirable to know the precise location of the ship than when it and all approaching vessels are enveloped in the impenetrable screen of vapor. The steam whistle is the device that naturally suggests itself for the purpose, and it has been widely employed; but its use involves inconvenience, unreliability and great expense. If simply a steam boiler and whistle are employed, the steam is never ready when wanted, and often before it can be got ready the fog has lifted and all the expense of firing up has been for nothing. Then there is also the trouble about the salt water for the boiler, that we need not here dilate upon.



COMPRESSED-AIR PLANT ON LIGHT-SHIP. SECTIONAL VIEW LOOKING AFT.

Steam cannot be stored, while compressed air may be held in readiness for an indefinite period, and operates the whistle even better than the steam. The use of steam-driven air compressors is, however, almost as objectionable for this service as the direct use of the steam upon the whistle. The receiver capacity must be very large if enough air is to be stored to keep the signal in operation in a sudden fog until the steam compressor can get into operation, and then the cost of operation and maintenance is found to be very great.

The plant to which we now have the pleasure of calling the attention of our readers evidently avoids the principal objectionable features of the steam system. The air compressors in this case are actuated by oil engines instead of by steam, and having said this it might be thought that not another word of explanation or description would be required; but if it is looked into a little, it will be found that even the application of the oil engines involved considerable thought and care.



PLAN OF COMPRESSED-AIR PLANT.

Two oil engines are employed, each of 25 horse-power, and each operating a horizontal trunk-piston single-acting air compressor connected to a crank on the end of the engine shaft. Each engine and compressor is complete and independent, and entirely sufficient for the service required, the duplicates being provided to make certain the avoidance of all failure by disabling accident. The oil engine cylinders are 16 inches diameter and 20 inches stroke, and each engine runs at 180 revolutions per minute. The 25 horse-power is the available brake horse-power. The actual power required for the compression is only 15 horse-power. As the compressor is direct-connected, the high speed necessitated a large valve area, both for air inlet and outlet, which is supplied by a comparatively large number of small valves having a very small lift or opening.

The air, after compression, is stored in two horizontal receivers, each three feet in diameter and twenty feet long. They are charged to a pressure of 60 pounds to the inch. The air from the receivers passes a pressure reducer before going to the whistle, where it is discharged at a considerably lower pressure, thus enabling the receivers to maintain the supply for a time always sufficient for getting the oil engine and compressor in operation. The air, after passing the pressure reducer, also passes through a reheater which takes the exhaust from the engine, Fig. 3, thus increasing the volume discharged at the whistle and preventing the possibility of freezing in the passages. The whistle is 12 inches diameter, and the

opening is made somewhat thinner than would be required for steam. The whistle blows for five seconds and then is silent for fifty-five seconds, the operation being automatically controlled by clockwork.

The cylinders of the oil engines are, of course, water-jacketed, as is necessary with all engines of this class. The engines are found to give the best results where the water flows away at a temperature not exceeding 130 to 140 degrees. In the original design, provision was made for circulating sea water through the jackets, but it was thought unwise to run the risk of deposits from the sea water, and a plan was devised for using the sea water not directly in the jackets, but to cool the fresh water passing through them, so that it could be used over and over continually. This involved a double circulation, as shown in Fig. 4. The fresh water, after passing through the jacket, rises and enters a closed copper coil in a tank of sea water, and, after being thoroughly cooled in its descent through the coil, is ready to enter the jacket again. The circulation of both the salt and the fresh water is kept up by a small pump for each, as shown. The fresh-water pump is operated by the valve shaft of the engine, while the salt-water pump is driven from the crank shaft.

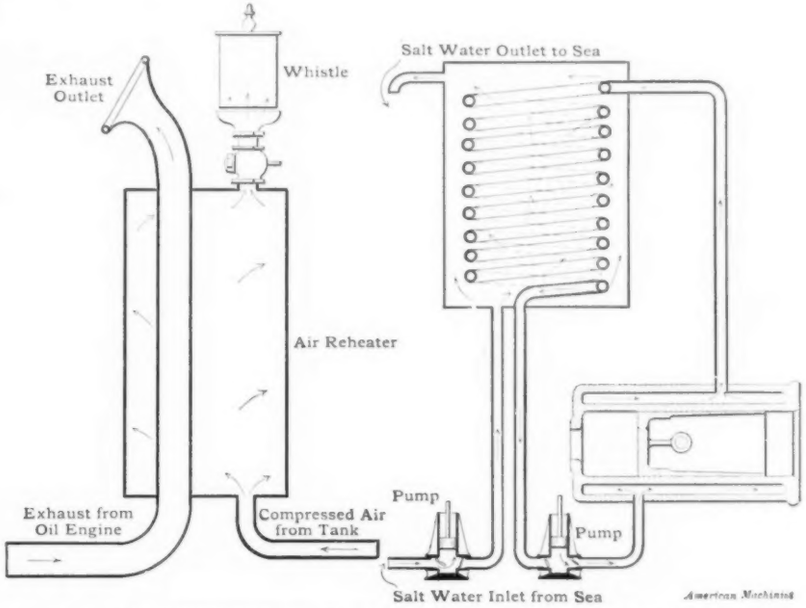


Fig. 3. AIR REHEATER.

Fig. 4. FRESH WATER COOLED BY SALT WATER.

The bilge pump of the ship is operated by connecting it with the air receivers, thus using the air instead of steam as the motive power. This is the most convenient method of operating any auxiliary machinery, such as windlasses, etc., and the capacity of the compressing plant is such that there is always a surplus of air if necessary.

To enable one man to start the engine, a self-starting device is applied to each engine. This consists of valve gear which, when operated, converts the engine for the time into a compressed-air engine. This valve gear is operated by hand, as only a few initial strokes of the engine are required under these conditions. The supply of compressed air for this operation of starting the engine is not taken from the main air receivers, but is contained in a small vertical receiver which is seen under the starboard horizontal receiver. A small air pump is provided for pumping up the air in this reservoir, usually to a pressure of about 100 pounds. It is not necessary to operate the pump each time the engine is started, as the receiver communicates with the cylinder of the oil engine, and the products of combustion are allowed to flow into it under pressure, so that after the engine is once started a supply of air is constantly on hand.

The arrangement, as a whole, seems to show very decided practical advantages over any possible application of steam for the same purpose. The fog signal is always and instantly ready for use, which is the principal feature, and it is also operated much cheaper than is possible with steam; the weight of fuel required to be carried is much less, and it is much easier handled and stored. The consumption of oil is but one pound per horse-power hour, and there is no waste from idle steaming or heating. The oil is only consumed for actual work, and with the cessation of work the oil consumption ceases instantly.

The plant here illustrated is upon lightship No. 42, which is stationed in Vineyard Sound, off Cape Cod, and was furnished by the De La Vergne Refrigerating Machine Company, of New York, under the direction of Mr. George Richmond, of the company, the oil engines being the now well-known Hornsby Akroyd oil engines, of which the above firm are the manufacturers in the United States.

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Mechanical Engineering at Columbia University.

We are in receipt of a series of pamphlets giving the announcements of the various technical courses of study offered at Columbia University, and we note with interest that, beginning with the autumn of next year, when the university will be removed to its new site on Morningside Hights, where a series of superb buildings is now in course of erection for its use, a course in mechanical engineering will be instituted.

The course offered is of the usual four years' duration, but we are glad to see that students are urged to take two preliminary years of work in the liberal and literary departments before entering the engineering department. This is a move of whose wisdom there is no doubt. The impatience of young men to "get to work" will, however, doubtless, interfere with its extensive adoption for some time to come, and we cannot but think that more would be induced to adopt the course recommended were these liberal studies spread through and incorporated with the technical course, so as to make a continuous course of six years' length. Doubtless, however, the difficulty of arranging two courses of different lengths so as to harmonize with each other without entailing a large amount of extra work on the part of the teaching force is serious, and perhaps the plan offered is the best that can be realized for the present.

The course is divided the last year into three branches or alternatives to suit the tastes or needs of those whose future is, in a measure, fixed. These alternatives are—First, the Dynamic; second, the Electrical; third, the Mining. The first covers what may be called the regular course, while the characters of the others are indicated by their names. The electrical alternative, it should be remarked, is not the regular course in electrical engineering which the university has maintained for some years, but is properly a course in mechanical engineering with an electrical bias. The existing course in electrical engineering naturally offers excellent facilities for this electrical alternative, and the same may be said regarding the course in mining and the mining alternative.

Attention is properly called to the fitness of this city for the seat of a school of mechanical engineering, forming as it does, with its environs, the greatest manufacturing center of the continent. In addition to this, the city itself may be said to form a university, and the effect on a country-bred boy of a four years' residence here cannot but be to enlarge his conception of life and of the world in a manner not possible in a smaller city.

ELECTRICAL MACHINERY.

Safety Stop Attachment for Power-House Engines.

The increasing number of fly-wheel accidents in the recent past has emphasized the necessity for additional safety appliances beyond the usual governor. We illustrate herewith such an attachment, as applied by the E. P. Allis Company, to the engines driving the electric generators of the Lenox avenue line of the Metropolitan Traction Company of this city—although, of course, there is no

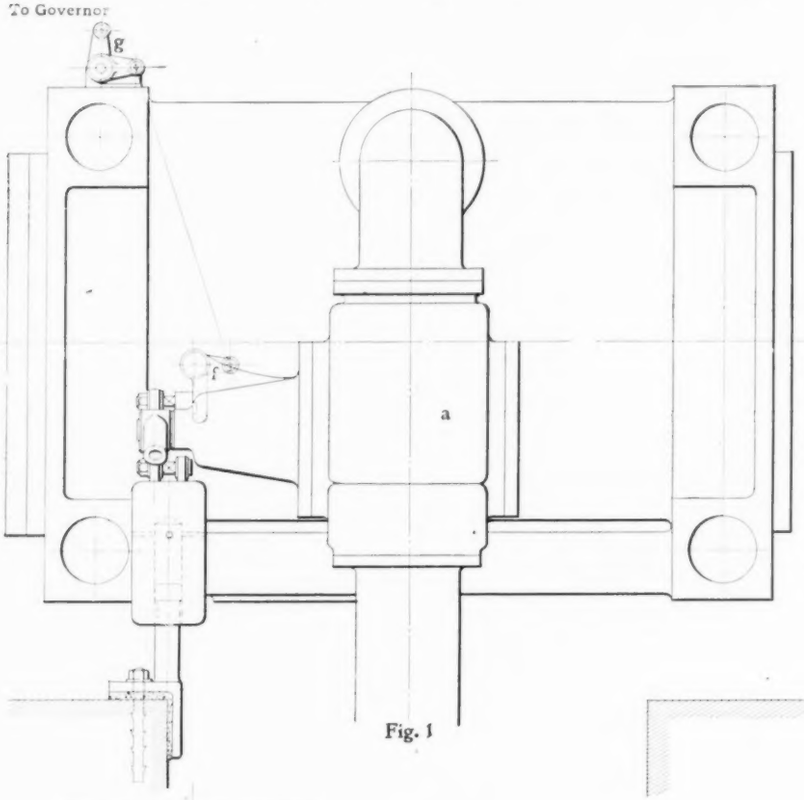

Fig. 1

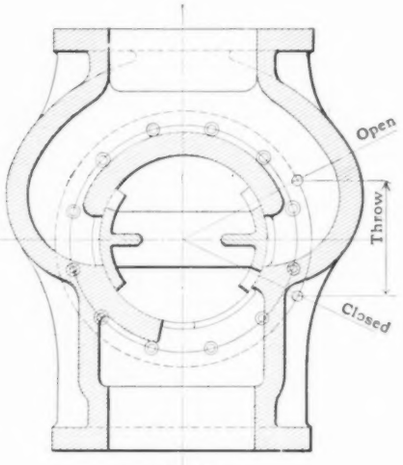

Fig. 2

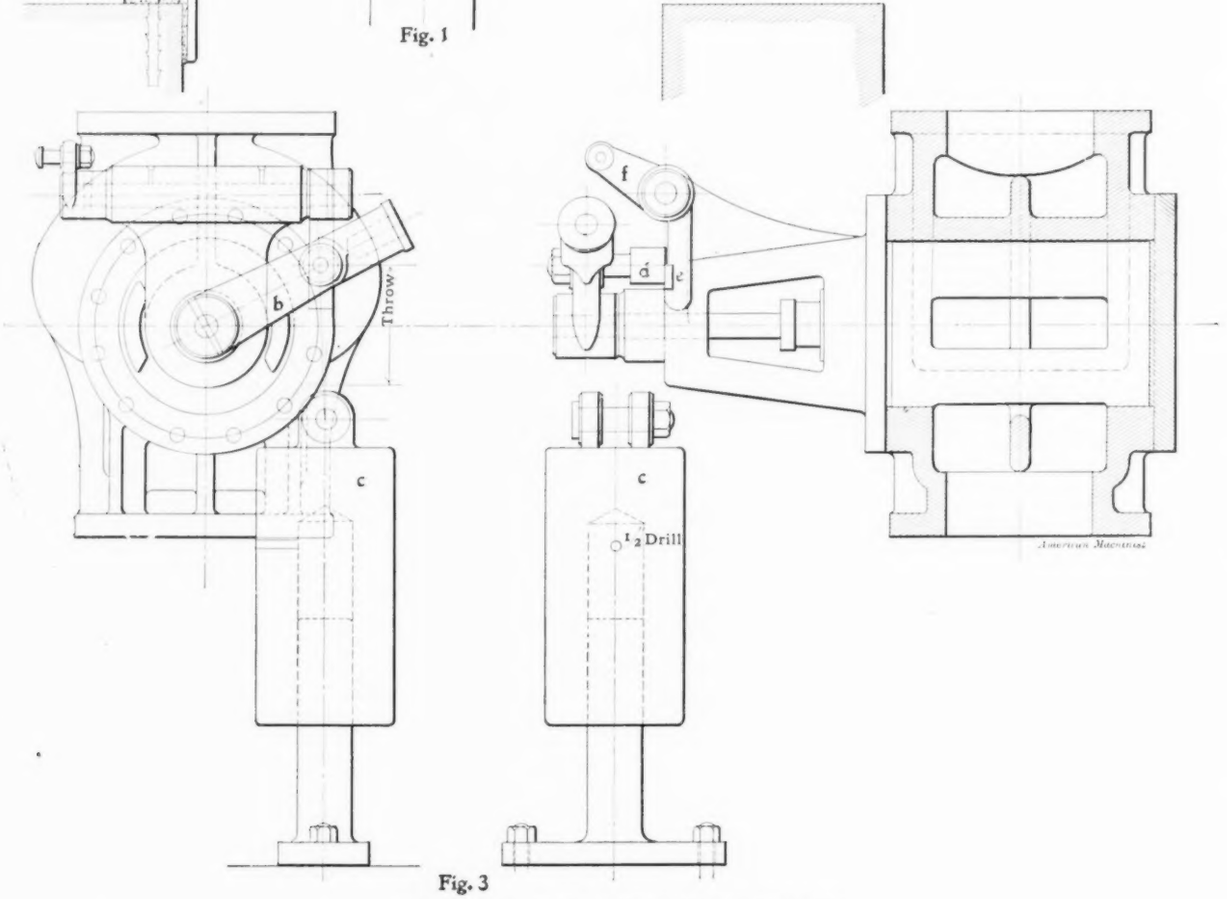

Fig. 3

SAFETY STOP FOR POWER-HOUSE ENGINES.

reason why the same appliance is not equally applicable to engines doing other duty than the driving of electric generators.

Fig. 1 is a side elevation of the high pressure cylinder of the engine with the safety stop in position. It will be seen that the steam main comes up through the floor, and on its way to the cylinder passes through a special stop valve *a*. It is the function of the safety appliance to close this valve whenever the speed exceeds the limit to which it is set. The means by which this is done are shown in Fig. 1, but more clearly in Figs. 2 and 3, which latter, however, are from a different engine and are slightly different in the arrangement, although in all essentials identical.

Fig. 2 shows a cross-section of the valve closed, which will be seen to be formed of a pair of turning slide or Corliss valves cast in one piece and hence balanced against the steam pressure. The stem of this valve has a socketed arm *b*, Fig. 3, attached to it, with a weight *c* hung therefrom by a link, indicated by its center line to avoid covering up the other parts. The office of this weight is to turn the valve to the closed position, which, however, it is normally prevented from doing by the latches *d* and *e*, *d* being attached to the arm *b*, while *e* is attached to the swinging arm *f*. This swinging arm will also be seen (denoted by the same letter) in Fig. 1, and from it center lines and bell crank *g* indicate how it is connected to a governor. This governor is additional to the regular governor controlling the cut-off gear, and has no other duty than to act as a monitor and release the trip gear described whenever the speed exceeds that for which it is set, which speed is, of course, slightly in excess of that at which the regular governor maintains the speed of the engine. Should this speed be exceeded from any cause, the safety governor acts to open the latches *d* and *e*, when, of course, the released weight closes the valve. Resetting the device is a matter of but a moment, it being only necessary to insert a bar in the socketed arm *b* and raise it until the latches engage again.

The weight will be seen to be bored from below and to slide upon a turned post. An air hole will be seen to be drilled through the side of the weight, giving to the parts the action of an air dash pot, by which the weight is caught in its descent without slamming or pounding. Of course, at the instant of starting, before compression of the contained air, the weight acts with full force to start the movement, which, if started, will be certain to continue.

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Contracts for power from the great Niagara Falls plant have accumulated sufficient to absorb the entire output of the three 5,000 horse-power dynamos now in place. Extensions are in progress.

Electrical Devices for Changing the Speed of Shunt Motors.

BY WM. BAXTER, JR.

In two previous articles the arrangements most commonly used for changing the speed of constant potential motors, of the series-wound type, were discussed, and it was shown that although variations in velocity can be effected, they are not of such a character as to be of any very wide application in the operation of machinery in general. The defect of these arrangements is that for any given speed there is a corresponding torque, and these two are seldom likely to be in accordance with the speed and resistance of the apparatus that is to be driven. With shunt-wound motors better results can be obtained, as with these there is not a fixed relation between velocity and rotative force.

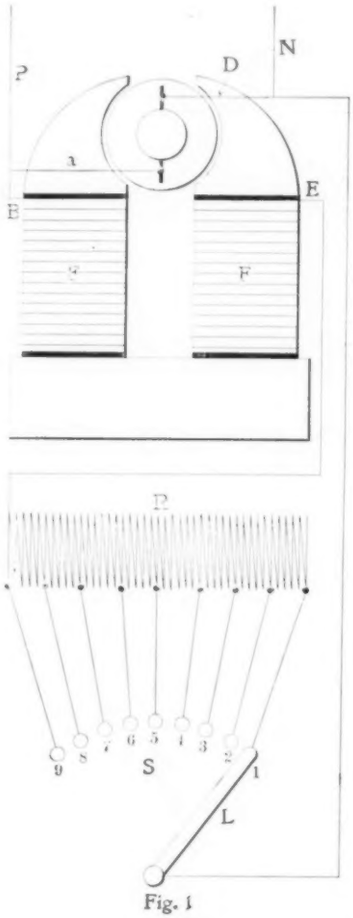

Fig. 1

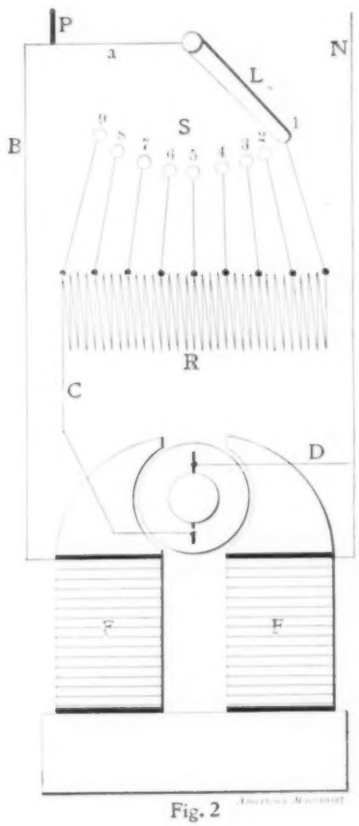

Fig. 2

CHANGING THE SPEED OF SHUNT MOTORS.

Fig. 1 shows the method most commonly used for varying the speed of shunt-wound motors. It operates upon the principle of changing the strength of the field, which is accomplished by placing in circuit with the shunt field coil an external resistance and a switch, so arranged that any part or the whole of this resistance may be brought into action or not as the conditions may require. The current entering the motor by the wire *P* is divided at the junction of *a* and *B*, the greater part passing by *a* to and through the armature to wire *N*, and the remainder by wire *B* to the shunt field coil. After passing through this coil, the field current goes through wire *E* to the resistance *R*, and after passing through this, gets into wire *G* through the switch *S* and from *G* to *N*. When the lever *L* of the switch is placed on the first contact, the current will pass through all the resistance *R*, as well as through the field coils, and, under these conditions, the magnetism of the field will be much lower than it would be if all the resistance *R* were removed. By moving the lever *L* from one contact to another, any amount of the resistance can be placed in the circuit; and, consequently, any strength of field from the highest, which is obtained when all the resistance is out, to the lowest, which is obtained when all the resistance is in, may be had. As the current through the armature passes directly from wire *P* to wire *N*, the counter electromotive force, or back pressure, developed by the armature must be sufficient to keep the current down to the amount necessary to develop the torque required to drive the machinery operated by the motor. The speed at which this back pressure will be developed will de-

pend upon the strength of the field, and this will depend upon the strength of current flowing through the field coils; hence, if the resistance of R is high enough, the speed may be made very great. If the resistance of the field coils is made very low, and the number of turns very great, which can be effected by using sufficiently large wire, the velocity with all the resistance R cut out will be very low; therefore, a wide variation may be obtained with this arrangement, but this requires the size of the motor to be much greater for its power than commercial considerations would permit. At any velocity at which the motor may be able to run with the resistance R, or any part of it, in service, the speed will be practically constant without regard to the load; therefore, within the range of change obtainable by this method, the torque required to do the work will have no effect upon the velocity.

With this method of varying the velocity only an increase of speed beyond the normal velocity of the motor can be obtained, and therefore this normal velocity must be as low as the lowest desired, to enable the system to fulfill the requirement of any case.

It is evident that at best the greatest variation obtainable under practical conditions is small, therefore the number of cases in which this system is able to meet the requirements is limited.

There is only one method by means of which a wide range of velocities can be obtained, but it has the drawback of being inefficient in its use of current. This arrangement is shown in Fig. 2.

As will be seen in this figure, the current from the line wire P goes directly to the shunt coils of the field, and, after passing through these, goes to the other line wire N. The strength of the field, therefore, is always the same; and as a constant field produces a constant velocity of the armature without regard to the changes in the resistance that opposes rotation, the speed will be constant at any velocity for which the regulator may be set. The regulator consists of a resistance R, which is placed in circuit with the armature. As the electrical pressure between the wires P and N is constant, the amount available for rotating the armature will be dependent upon the resistance of R. If this be made high enough, the pressure at C may be so low as to barely be able to produce rotation. When the lever L of the switch S is in the position shown, all the resistance of R will be in the circuit, and the velocity will be the lowest possible. By advancing L step by step over the contacts 2, 3, 4, etc., as many different velocities may be obtained as there are contacts, the lowest one being dependent upon the amount of resistance in R, and the highest being that at which the motor will run when utilizing the full pressure of the current.

In this arrangement, as will be seen, the changes in velocity are from the highest speed of the motor down to a point which may be made as low as desired, by making R of sufficient resistance. So far as the changes in speed are concerned, this method is entirely satisfactory; but it is unsatisfactory on account of the great waste of energy that is unavoidable in any case where more than a small variation is required. If the resistance R balances one-half of the electrical pressure, one-half of the current energy is thrown away; if it balances three-quarters, three-quarters of the energy is lost, and so on for any other proportion. From this it can be seen that if the full speed of the motor is, say, one thousand, and it is desired to reduce this to one hundred, nine-tenths of the current must be absorbed by the resistance. Such waste of energy cannot be tolerated except for small powers; therefore the method is of limited value.

From what has been said in this as well as the preceding articles on this subject, it will be seen that of all the electrical arrangements that are used for varying the speed of motors, only one can produce as wide a range of velocities as is necessary in the great majority of cases, and this one accomplishes the result by such an extravagant use of energy that it cannot be regarded as of anything more than limited application. The arrangements that are of high, or even fair, efficiency give a range of velocities that is far below what is required in the majority of cases; and it is on this account that, as a rule, constant-speed motors are used, and the changes in velocity are obtained by some one of the various mechanical methods.

In operations where it is desired to change the speed only 30 or 40 per cent., the first method described in this article can be used to good advantage; but when the change is great, as, for example, in a lathe, which may vary from 50 to 200 or 300 to 1, it would be simply useless, and this may be said of all the other arrangements.

Electricity can accomplish so many things in an exceedingly simple manner that those who are not familiar with the subject are inclined to believe that it can be made to do anything, and with devices of the simplest character; but this is not so. There are some cases to which it is specially adapted, and in these it can accomplish results with simple apparatus that could not be accomplished mechanically except with great complication; but varying the speed of motors within wide limits is not one of the cases where it can produce results of this kind—at least not by any arrangement now in use. The limited range of speeds which can be obtained with economical methods is one of the greatest commercial drawbacks of electric motors.

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Shunt motors are being introduced on European electric railways.

Letters from Practical Men.

Planer Speeds—Belt Lacings—Grinder Dust.

Editor American Machinist:

In the November 12th issue, Mr. C. O. Griffin says that Mr. W. O. Webber's high planer speed has shocked him, and it is my opinion that some of the internal arrangements of the planers received a shock also. Mr. Webber has omitted the all-important part in his article by withholding a description of the work in progress, also kind of tool steel used. I have taken the "American Machinist" eighteen years and tried to keep in line with the rest; but when it comes to taking heavy cuts, with high speeds and coarse feeds, on big castings, steel forgings and steel castings, I have never had the good luck to see or hear of any steel ahead of "Mushet's." It comes high, but in my experience I find it pays on this kind of work.

I have had shapers run 50 feet a minute on short work on very soft cast iron, where the nature of the castings was such that heavy feeds and wide tools would spring them out of shape, and probably this is the kind of work Mr. Webber means when he says it comes out truer when planed at high speeds. I am writing about shaper work; but when it comes to snatching a big, sedate and dignified planer bed back and forth like a corn-popper over a hot griddle, just excuse me from guaranteeing good work from such a performance. If Mr. Webber's article should prompt someone (who don't know any better) to attempt to use a 30-foot cutting speed an a big casting where the tool has to go through ⅜ inch of burnt sand in some places, and lumps of iron 1¼ high in other places, a very short experience will be sufficient. Nothing can be accomplished on such work by running over 14 feet cutting speed. Increase the feeds and use slow speeds is the way to save money and trouble on such work.

I have had round machine steel bars turned from 3 inches to 2¾ inches diameter at one cut, using half-inch feed with tools 1¾ inches wide, and producing elegant surfaces, but could get no steel for tools which would stand over 12 feet cutting speed, and could produce more work for the same money by keeping the speed below 10 feet per minute.

Mr. Bonsall, of the Buckeye Engineering Company, also tells of roughing cast iron and steel at a speed of 35 to 40 feet per minute, but, like Mr. Webber, neglects the important features in the case; that is, kind of tool steel used, kind of work, feed, depth of cut, amount of surface finished per hour (square inches or square feet), nature of surface produced, and its cost as compared with surfaces finished at slower speeds. It all depends upon the nature of the work; light work needs light quick-speed cuts.

I once saw a 36 x 14 inch pulley turned

at the rate of 790 square inches of surface finished per hour; that is, a rough and finish cut taken and sides of the rim trimmed (rim 1¼ inches thick). The cutting speed used was 18 feet per minute. Now, if there is any tool steel in the market which would accomplish this work in half the time by running 36 feet per minute, I want the Chicago agency for it at once; there would be a fortune in it.

I notice in November 5th issue that Mr. Tecumseh Swift tackles that hinged belt lacing, and proceeds to administer a few knock-out blows thereto. But in its defence I remember a belt which was driving a 14-inch fan in a shop where I was, three years ago; this belt would pound off the lacing at the edges of the row of holes which struck the pulley first. This thing happened every week. We took on a new machinist one day who, after seeing this belt give out a couple times, said he'd fix it, and put in a hinge lacing; that belt ran eight weeks before the lacing gave out again.

Mr. Swift says that the lacing in a belt is the most flexible part. Mr. Swift is mistaken, and if he makes a lacing, drawing the butts of the joint solid together, and laces over and over, as is most common, he will find it the stiffest. Where a thick heavy belt joint is cracked around a small pulley at the rate of 5,000 feet a minute, it is about as hard on the lacing as if it were held still on an anvil and mauled with a sledge. If you want a fastening that will stay with you, just splice and glue it. Belts are run on routing machines at such terrific speed that the parallel sides belly out like a hoop skirt.

Speaking of the trouble Mr. Swift had in disposing of dust from his pulley grinder, it would have been easily disposed of to have discharged it into a vat of water—carried the end of the exhaust pipe down within a few inches of the water surface, leaving the vat large enough to be conveniently cleared of the accumulated mud and iron dust. I find it saves many a sneeze to have a shallow water pan to catch dust when grinding cast iron.

W. H. CHAPPELL.

Harvey, Ill.

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A Box Tool for "Cones."

Editor American Machinist:

Trusting that I am not intruding on Mr. Dolnar's territory, I offer in the accompanying sketches a style of box tool successfully used by one of the large cycle manufacturers for the finishing of the front end of a wheel cone, cut from the solid bar of "special tool steel made exclusively for us," which means a soft fine grade of machine steel that will take a fairly good tough temper, if packed in iron boxes with charcoal and bone dust, heated in a furnace managed by a man who knows a thing or two about case-hardening.

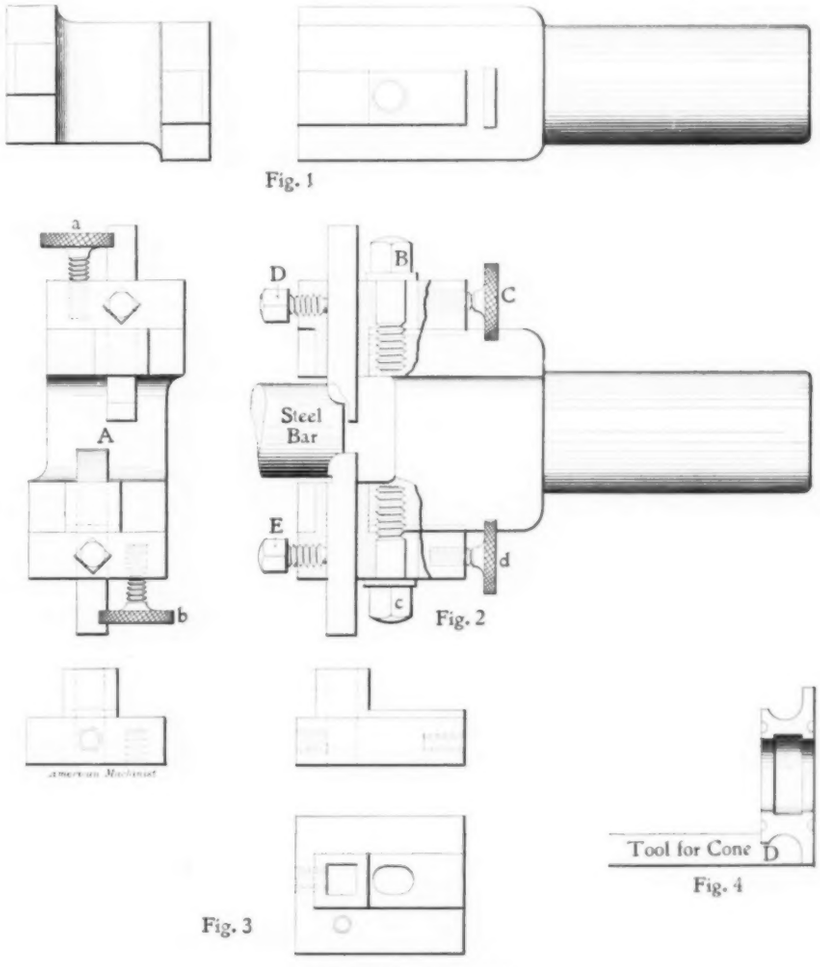
Referring to Fig. 1, the body of the tool is made from a forging of machine steel, with slots or ways milled in to receive the adjustable holder shown in Fig. 3. Slots in the body are cut right and left from the center, to allow the cutting edges of tools to square with each other across the center, as shown at *A*, Fig. 2.

An end of the bar of steel with the tools in position for cutting, and a sectional view of tool complete (Fig. 2), plainly show the construction.

Screws *a b c d* are for adjusting cutters to length and depth; cap screws *B* and *C* clamp the tool holders securely to the body, and *D E* hold the tools stationary.

Fig. 4 is a sketch of the milling cutter for forming the tool *D*.

D. E. MACCARTHY.



A BOX TOOL FOR CONES.

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The Reamer Question.

Editor American Machinist:

If this grinding a reamer to size and so it will not chatter at the same time, by turning it backwards in a hole with a little emery and oil, as described by Almond and Hemenway, fills the bill, then an account of a less simple way is only justifiable on the score of novelty. We find that a four-fluted hand reamer, with left-hand spiral, increased twist, does the business for straight holes; and a taper reamer with the first flute straight or slightly spiral, and the next flute more spiral, and the next flute more spiral yet, and so on up to half-way around, and then each succeeding flute with less and less spiral to the last, makes a tool that is simply perfect. I should not expect a taper reamer with its cutting edges dulled by the back grinding to work very easily.

JOHN E. SWEET.

Syracuse, N. Y.

How the Size of Calipers is Determined.

Editor American Machinist:

Will you please settle the following argument, in your Question and Answer column, if you think it of general interest?

"A" says that the size of calipers is determined by the distance from the center of rivet to the end of the legs in a straight line. "B" says that it is the distance that they will open.

DAVID T. FLETCHER.

Torrington, Conn.

Editor American Machinist:

It is the rule of all caliper manufacturers, we think, to measure the size of

calipers or dividers from the rivet to the extreme end of the legs. We have never heard of any manufactory measuring the calipers by the size which they would open.

We would particularly call your attention to page 39 of our old tool catalog, which we mail with this, which will explain the point in dispute, and also to page 40 in reference to the size of circles that may be drawn with our different size dividers.

J. STEVENS ARMS & TOOL CO.
Chicopee Falls, Mass.

[The catalog mentioned explains that in the case of dividers a circle may be drawn whose diameter is equal to twice the nominal size of the tool.—Ed.]

Editor American Machinist:

We make our calipers to measure from center of rivet to points, the size for which they are listed, and also to caliper the same, for instance, a pair of 5-inch calipers will measure from center of rivet to point 5 inches, and will also open at least 5 inches. * * * A pair of 5-inch calipers must measure not less than 5 inches from center of rivet to point, and must open not less than 5 inches. If they are larger than that, but not large enough to reach the next size in both directions, they are still, in our opinion, 5-inch calipers.

ATHOL MACHINE CO.
Athol, Mass.

Editor American Machinist:

When spring-bowed calipers are correctly made, the distance from the center of the rivet to the end of the legs and the distance they will caliper should be equal. A 6-inch caliper means both, that it is 6 inches long from the center of the rivet to the ends of the legs, and that it will caliper 6 inches diameter, so your disputants are both right. Firm joint calipers are usually designated by the length of the legs, but they will caliper a greater diameter than said length.

THE L. S. STARRETT CO.
Athol, Mass.

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Testing in the Schools.

Editor American Machinist:

Your article in the November 26th issue, entitled "Testing in the Schools," seems a fair subject for discussion, and I respectfully submit the following for criticism:

In the first place, the word "testing," as it is used, is probably intended to include the work in the technical schools that should more properly come under the head of experimenting.

The student usually does very little or no testing until he has undergone a course of experiments which familiarizes him with the apparatus used in engineering work. Too much time would be required to construct the smallest portion of the machinery he handles in the laboratory.

The mechanical efficiency, which seems to be rather underrated in the article, is used more as a means for the student to detect the underlying principles, and of increasing the efficiency of the machine from the study of these principles.

Horse sense is born in a person, and the tricks of interested parties can best be detected by the engineer who knows where to look for the cause of the trouble; and this knowledge can only be obtained from handling the machinery on tests, or otherwise, and not by studying the drawing board or working in the shop.

GEO. H. MERRILL.
Brooklyn, N. Y.

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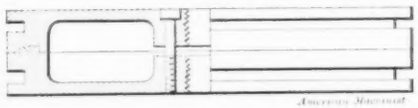
Fastening Pistons.

Editor American Machinist:

I saw in a recent issue of the "American Machinist" a cut of a piston head showing a way of fastening the same to the rod. I send you a sketch of the way I fasten my



FASTENING PISTONS.

heads, from 4 inches up to 28 inches, which is the largest size cylinder we have used so far, but expect to have larger before next summer is over. Our large pistons are made conical to reduce weight. I have used this style of fastening for four years on fore-and-aft compounds and on steeple compounds. I did not think it was any invention, but was sure that it was safe and reliable, as I had fitted one up and then fastened two dogs to the rod, and used a 4-foot lever to turn it. The head is in two halves, machined all over.

CHAS. MITCHELL.
Glenwood-on-Hudson, N. Y.

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The "Condensed" Engine in a Launch.

Editor American Machinist:

Thinking you might like to know of the success of the little "condensed engine" which you so kindly illustrated and described in your issue of January 30th, I can say that I have just completed and tried a 27-foot launch which I designed and built expressly for the engine. The boat is 4 feet 8 inches beam, 25 feet water line, and draws 16 inches of water. I have built a small all-tubular upright boiler which is carried astern of the engine. Gasoline is used for fuel, being delivered to the retort and firebox by air pressure from a tank under the forward deck.

I use a keel condenser, consisting of two tubes 10 feet long; the outside 3 inches diameter, the inner 1½ inches; the outer tube being shrunk onto a taper heading and the rim expanded at the end. The exhaust is taken to the forward end and enters the annular space between the tubes, the air pump acting upon the lowest point of the after end. My propeller screw is of bronze, has three blades and is somewhat original in design. It is 14 inches diameter and very carefully finished to a true pitch of 18 inches; the blades are somewhat "shelled," or concaved backwards, and have an approximate working area of 54 inches.

The engine (cylinders 1⅞, 2½ and 3½ x 2½ inch stroke) with a boiler pressure of 125 pounds readily turns this screw up to 700 per minute. The machinery all being aft gives ample seating capacity in the waist and forward for twelve or fourteen people. The boat proves very steady and fast for her length.

The performance of the machinery is very nearly noiseless and free from vibration, seeming more like the working of an electric motor than of a steam engine.

FRANK CAREY.
Penn Yan, N. Y.

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School Draftsmen.

Editor American Machinist:

In the issue of November 19th of your valued paper, I notice the remarks on "School Draftsmen" by Professor Gwinner. I have observed that the work of draftsmen who have studied in the shop drawing-room is much more satisfactory than that of those from technical schools. While school men do appreciate the necessity of locating the respective elevations in their proper places, and just far enough apart to get necessary room for dimensions, it would be a very poor sort of draftsman that would insert views of entirely different pieces. School draftsmen are also very particular regarding the proper curves, etc., of projections, although the time for such work cannot be afforded, and it is all nonsense to do it, as the pattern maker desires only a clear, intelligent drawing of the desired piece, with only the views necessary to enable him to get out the work with dispatch. And here is where the school draftsman begins to learn that drawings made at school and in the shop are two very different things; for in the shop he has to see that his work can be machined, and that the tools in the shop can handle it. Here is where the practical shop draftsman has the advantage; and I think if we take the profession through the United States, the shop draftsman will be found to have the preference every time, for superior knowledge and in salaries paid.

Now, I do not want to be accused of being hard on the school element; but, other things being equal, I would take a man who has served his time in the drawing-room, in preference to one from school, for it takes about a year to get one of the latter to make a proper shop

drawing and to leave out a lot of superfluous work, which only confuses and hinders the mechanic.

C. S. LINCH.

Philadelphia, Pa.

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Right-Angle Couplings—American vs. Egyptian Cotton Driving Ropes.

Editor American Machinist:

The "unique substitute for bevel gears" referred to by Mr. S. T. Freeland in your issue for November 12th, is not by any means a new device, since couplings of this kind were made at least a dozen years ago in England. An interesting application of this movement was made in connection with rotary engines about the time indicated, and I recollect seeing, at the Inventions Exhibition held in London in 1886, a small engine of the kind which received more than passing notice. The several bent rods were used in precisely the same manner as in the coupling; but the straight limbs passing through, or rather into, one of the rotating cylinders formed plungers or pistons on the ends of which steam pressure was exerted during a semi-revolution of the cylinder. I believe the admission, cut-off and eduction of the steam were effected by much the same means as are adopted in model oscillating engines, the end of the cylinder running in contact with a fixed disk in which portways were formed. In this way each plunger as it passed the center received steam until the supply was cut off by its orifice reaching the extremity of the admission port, and expansion and exhaust followed. If my memory serves me aright, only one cylinder was arranged in this way, power being taken from the other. There seems, however, no good reason why both cylinders should not be made active, and the power thereby doubled.

The practical objections to this ingenious type of rotary engine are very obvious; added to which the wear of the rods at high speeds was found to be considerable. In the case of the coupling, friction can be kept down by running in an oil bath, as pointed out by Mr. Freeland; but no such possibility exists in the case of the rotary engine. The application is an ingenious one, but the practical value of an engine arranged on these lines is not worth considering.

In the course of an interesting discussion on Rope Driving recently, some interesting particulars were given as to the relative value of American and Egyptian cotton as materials for driving ropes. At first sight it would appear that the fine strong silky Egyptian staple would prove more satisfactory for this purpose than the coarser American variety. Many rope-makers have all along assumed this to be the case, and Egyptian yarn has in consequence been largely used. A Lancashire firm of rope-makers, however, determined to compare the two varieties in actual work. They therefore procured some of the finest Egyptian yarn obtainable, from which a number of ropes were made. These were run side by side with a similar number of ropes made from equal spinnings of American yarn. A drive was selected for the test in which (by reason of the abnormally high rope speed) the ropes were only used for a certain period, after which they were removed and used on slower-speeded engines. The two sets of ropes were put to work, and after the usual period had elapsed, were removed and carefully examined, when it was found that the ropes made from American cotton were in a distinctly better condition than the others. The makers estimate this difference at 12 per cent., but omit to state how they arrive at this particular figure. In any case, however, the test serves to show that theoretical conclusions in matters of this kind should be confirmed by practical experiment before being finally accepted.

M. E.

Manchester, England.

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Planer Speeds—Influence of Shape and Condition of Tools.

Editor American Machinist:

You have given your readers some interesting reading of late on the subject of "Power and Time Tests" of machine tools. There are features connected with this subject, I think, which have not been brought out, that may be worth considering. These relate to the relative difference in the power required when good or bad cutting tools are used, and what is still more important, perhaps, is the effect a disregard of these conditions may have on both the quality and quantity of work done.

Both experience and observation lead me to believe that, as a rule, foremen in the machine shop are too much engaged with what may be regarded as more important duties than that of giving instruction in the use of tools. As an example, an apprentice boy, perhaps, is given charge of a lathe or planer for the first time; he finds only a partial set of tools on the board, and those inferior ones. The only alternative is to exercise his wits and to do the best he can. May not this account in some degree for the fact that we rarely find two persons who grind or shape cutting tools alike? Of course, the regular toolboard sets are meant, which are not usually kept in a tool-room.

The old adage, "A workman is known by his chips," has an application here, and in passing through the machine shop, it requires no unusual amount of skill or acumen to apply this rule with a good degree of certainty. Aside from the saving of power by the use of tools that cut easily, there are other obvious reasons why tools should be made to cut and not tear the metal away from the work. A lathe for example may have belt power sufficient for any work it will swing, when the cutting conditions are favorable; but with dull or improperly formed tools, its limit of power is often exceeded.

It is also clear that the tool which offers the least resistance in removing metal will do better work, cut smoother and hold its edge longest. Just here I must say that it is often a matter of surprise with me to find so many machinists who do not appreciate the use of an oil-stone; in fact, there are many shops where this useful article is almost unknown. It is a fact, I think, which everyone who has tried it will admit, that a cutting tool that has been honed after grinding will hold its edge longer than when used as it comes from the grindstone or emery-wheel. Besides, when a smooth finishing cut is to be taken, I regard the oil-stone as indispensable.

It would be of interest, I believe, to many of the readers of the "American Machinist" if those who are dealing with the dynamics of this question would give us the results of observations along the lines I have indicated. We may in numerous ways form approximate estimates of the power consumed by blunt and illy shaped tools. The hand-tool which was so much used forty or fifty years ago affords an example, or, better still, the hand planer which is still in use enables the operator to get a clear conception of the saving of muscular effort by careful attention to the shape and condition of the cutting tool he uses. Those, too, who have been required to squeeze out a screw thread on a bolt with the old-style stocks and dies, will have had a striking object-lesson when comparing this method with that of manipulating the modern style of screw-cutting tools.

QUIRK.

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Variations in the Pitch of a Long Screw.

Editor American Machinist:

After reading your views, and those of Mr. De Leeuw, on this subject, it appears that nothing has been said about the torsion of the lead screw itself. It seems to me that if the lead screw were twisted to the same extent as the blank screw that was being cut, then the pitch of the screw would be the same as that of the lead screw, as the errors produced from these two causes are in opposite directions. As a matter of fact, I do not suppose they would ever be twisted to exactly the same extent, as they would be of different diameters, and the friction in lead screw nut would be different from that of the cutting tool. However, the torsion of the lead screw would partially compensate for the torsion of the blank.

WALTER GRIBBEN.

American Machinist.

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The Metric System by Compulsion.

We do not believe that an attempt should be made to make the use of the metric system of weights and measures compulsory, and do not believe its use can be actually forced upon the American public. We think that if the system is really, all things considered, better for practical use than our present lack of system, it will force itself into use; and in doing so, the change will be made with the least possible disturbance and expense. In other words, each step leading to the complete change will be taken only because that step is, at the time it is taken, economically advantageous for the man or men who take it.

The Council of the American Society of Mechanical Engineers has, however, appointed a committee to prepare material for opposing compulsory legislation by Congress, which committee will, we fear, oppose such legislation on what we must consider much weaker ground. This committee is composed of the following members: Coleman Sellers, John E. Sweet, Chas T. Porter, Geo. M. Bond and Coleman Sellers, Jr., most if not all of whom we believe are on record as opposed to the metric system *per se*, and believe that it is intrinsically inferior to our present weights and measures. On this point we think the weight of the testimony will be overwhelmingly the other way, especially of such testimony as can be brought to bear on a Congressional committee that may have the matter in charge.

We admit the great dynamic or rather potential force of a committee with such a notable personnel; but yet it seems to us that the recent experience of humanity at large, in changing towards a uniform system, is against them on the pure question of intrinsic merit.

It is a strong committee—perhaps the strongest that could be named—but judging from what we know of the opinions of its members, it is likely to attack the question from a standpoint which we must believe will be tactically wrong.

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"Made in Germany."

Things do not always work just as their inventors intend them to work. Sometimes their action is entirely the reverse of what was expected and a great surprise is accomplished. England has a "Merchandise Marks Act" which requires that "Made in Germany" shall be indelibly stamped upon every article to which it will truthfully apply. The intention of the act is, of course, that every Englishman as soon as he sees the obnoxious label shall know that the article is necessarily of inferior quality, and there will be either no sale for it or it must be sold at a ruinous sacrifice.

The actual experience of Germany is that the affixing of the required stamp has been a service of great value to German manufacturers. The mark turns out to carry a presumption of excellence and superiority, rather than the reverse, and it is claimed that German-made goods could have had no better advertisement. The enforcement of the act reveals the fact that goods of German make had heretofore been masquerading as English or French, and foreign buyers, instead of buying them in England, now buy direct from German houses.

It is not strange that it is now proposed in England to abolish the "Merchandise Marks Act," but will the abolition of the act abolish the marks?

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Honorable Wealth.

Those who imagine that there is a prevalent "jealousy of wealth" and a hatred of wealthy men, simply because they are wealthy, might profitably contemplate the career of the late William Steinway. Here was a manufacturer who, solely because he was a man of extraordinary business and other ability and had the willingness and capacity to do a prodigous amount of hard work, amassed a fortune. Neither in getting it nor in using it was Steinway ever accused of wronging others; on the contrary, his success in business was entirely deserved. He made a thorough study of his business, built the best instrument he knew how to construct, and sold it at a legitimate profit—at a price people were glad to pay, rather than pay a lower price for an inferior instrument.

In his use of his money he was broad-minded, liberal and public-spirited, and in every respect the world is the better for his having lived in it.

Fortunately, the American people readily distinguish between men who gain and use wealth in proper ways, and those who grow wealthy by questionable methods or downright dishonesty—purchase of legislation, etc.—and the so-called "jealousy of wealth" is little else than a perfectly proper protest against being robbed.

The jealousy of men who get wealth by fair means, and who do not misuse it, is a negligible quantity.

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Self-Enforcing Commercial Laws.

Though it is true as is being pointed out that the collapse of the Nail Trust organization shows that trusts must still be governed by the universal laws of trade and cannot safely set these laws at defiance, yet the possibility of such trusts being organized and maintained even for a limited time is in itself an evil and a danger.

Little or nothing is to be learned from this latest failure that could not as well be learned from the previous collapse of the syndicate which attempted a few years ago to control the world's output of copper.

It is a well-settled fact that prices established by a trust must usually not be so high as to tempt too strongly the avarice of those outsiders who can command the means of effective competition.

Those who manage the affairs of the Standard Oil monopoly seem to fully understand this, and it is almost impossible to conceive that those who organized and managed the late lamented Nail Trust were not equally well acquainted with this limitation, and that, for what appeared to them good reasons, they deliberately chose "a short life and a merry one," or in other words, thought it better to get every cent possible out of the public within a short time and then go to the wall.

There is nothing in the incident, so far as we can see, to forbid a similar organization in the future, to be operated upon the same plan or upon a more conservative one as may seem the best policy at the time.

We do not purpose to condemn, nor even to criticise, individuals who go into such affairs, nor those who manage them; but it ought to be plainly evident that such organizations are detrimental to the public interest and ought to be legislated against on that account, even assuming that they do nothing more than agree not to subject themselves to competition.

But, in fact, most of them do much more than this, and many of their acts are intrinsically vicious; the general public sentiment thus brought to bear against

them being not always fully discriminative, but sometimes directed against perfectly legitimate, proper and fair business enterprises, especially those which are so fortunate as to be notably prosperous. Indeed, this stimulation of the too prevalent idea that all corporations and all notably successful business enterprises are in themselves necessarily bad, is perhaps the worst effect of trust operations.

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Literary Notes.

LA MACHINE À VAPEUR (The Steam Engine). General Treatise, Containing the Theory of the Work of the Steam, an Examination of the Mechanisms of Distribution and of Governing, a Description of the Principal Types of Apparatus, a Study of Condensation and Production of Steam. By Edouard Sauvage, Professor in the Superior National School of Mines. Paris; Beaudry & Co.

The sub-title of this somewhat pretentious work conveys a fair, though brief, summary of its contents. In the first volume are considered, after some elementary descriptions, the laws of mechanics and physics pertinent to the subject in hand, the work of steam and its distribution, and finally the transmission and governing of motion. The second volume continues the consideration of the steam engine, and branches out into a description of boilers and of a variety of steam appliances. The work is fully illustrated, and yet it is really a treatise upon the steam engine rather than upon steam engines. The author sets out, primarily, to lay down the theory of the subject, using the concrete examples employed as illustrations of types rather than to amass a compendium of manufacturers' catalogs. While containing a good deal of theory, as to steam distribution, etc., the pages are not over-burdened with complex mathematical formulas. No doubt this work will find a place to fill upon the shelves of French engineers, or those of American engineers who are able to avail themselves of erudition buried in a foreign language—and that it will fill such place well. At the same time it seems hardly probable that a work of a diffuse nature like the present would come into general recognition among those who cannot read it with facility; such destiny being reserved for books which are founded upon the results of original investigation by the author in some special line. The present work is none the less admirable in its own way. The two volumes, 7¼ x 11 inches, contain together 1,011 pages and 1,036 illustrations.

WIRE ROPE TRANSPORTATION IN ALL ITS BRANCHES. The Trenton Iron Company, Trenton N. J. 167 5½ x 8-inch pages, 140 cuts and numerous full page and folded plates.

This is one of those publications of which an increasing number is being supplied by manufacturing companies, and which, while primarily intended as advertising matter, nevertheless give a large amount of useful information. The present book is, in fact, a treatise on Wire Rope Transportation, and contains more information on that subject than any book with which we are acquainted. It covers wire rope tramways, conveyors, mine hoists, haulage plants and power transmission. Illustrations of existing plants are given in profusion, as well as numerous drawings of details and various systems of lay-out. Practical formulas are also given, covering the points which require calculation. This book is of the best class of trade literature and of decided usefulness.

The Brown & Sharpe Manufacturing Company, Providence, R. I., announce new and enlarged editions of their two books on Gearing—the one entitled "Formulas in Gearing," and the other "A Practical Treatise on Gearing."

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(206) R. E. E., asks: Will you tell me a good method for drilling small holes in glass, in regard to style of drill and speed of machine and lubricant to be used; by small holes I mean ⅛ inch or smaller? A.—Put a piece of brass tubing in the drill-press spindle, the outside of the tube being equal to the size of the hole you desire to make. Revolve rapidly, and feed with emery and water. For making holes in thin glass, put a piece of stiff clay or putty on the part where you wish to make the hole. Make a hole in the putty or clay equal in diameter to that of the hole you wish to make, letting the hole reach the glass, of course; into this hole pour a little molten lead, and the piece will drop out.

(207) W. R., Washington, D. C., writes: 1. In "Strength of Materials," by Andrews, he discusses the stress upon crank pins and on page 147 says: "For example, if we had an engine working with the full pressure of steam during the whole of the stroke, and another of precisely equal power working with the same steam pressure at the commencement of the stroke, but cut-off at ½ of the stroke, the mean pressure on the piston of the latter engine would be .846 of that upon the other piston; and hence to enable them both to perform the same amount of work, the area of the piston of the latter would have to be 1.18 times greater than that of the former, and the maximum strain on the crank pin and crank shaft of the expansive engine would be 1.18 times that upon the crank pin and shaft of the other engine, although the horse-power transmitted through the two shafts is precisely the same in each case." How do you get the .846, and also the 1.18? A.—The rule for finding the mean pressure of expanding steam is: Multiply the hyperbolic logarithm + 1 of the number representing the ratio of expansion by the absolute pressure at cut-off and divide the product by the ratio of expansion. In the case given the ratio of expansion is 2, and the hyperbolic logarithm of this, as given in the tables of logarithms, is .693. This plus 1 gives us 1.693. The pressure at cut-off being 1 pound gives us 1.693 to be divided by 2 for the mean pressure, and this is .846. This disregards clearance. 1 is 1.18 times .846. 2. Please explain "radians." A radian is equal to 57.2958 degrees. What does it mean and where do you get it from? A.—A radian is the length of an arc which is equal to the radius of the arc, and by computation it is found to contain 57.2958 degrees.

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Business Specials.

Transient Advertisements 40 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear wheels, gear cutting. Grant; see page 16.

Small brass work. H. D. Phelps, Ansonia, Ct.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Ideal Twist Drill Grinder. T. Hall, 853 B'way, N.Y.

Engine Castings ⅛ to 2 H. P. Finished boilers and engines. Grant Sipp, Paterson, N. J.

Presses and dies for bar and sheet metal work, Ferracute Machine Company, Bridgeton, N. J.

Unmounted Photos.—Bldgs., paintings, etc.; sample & cat. 15c. Moulton Photo. Co., Boston, Mass.

Just Issued—Catalog No. 8. Mailed free. Clayton Air Compressor Works, 28 Cortlandt st., New York.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Patent Soliciting of High Class.—D. Walter Brown, Counsel in Patent Cases, 111 Broadway, New York. Send for "Brief History of Patent Legislation."

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Improving the Twist Drill.

More attention than usual seems of late to have been given to the twist drill, with a view to its improvement. The twist drill, no one needs to say, is one of the most important, if not the most important, of the modern tools of the machinist. Those who can remember its first introduction as a manufactured tool for machinists' use can also remember the transforming effect it had upon machine-shop practice. Its advent may almost be said to mark the beginning of the trade in machinists' small tools. Machinists' supply stores began to spring up then, and they were soon stocked with taps, reamers, milling cutters, emery wheels and similar tools, besides the scales and squares and calipers and other conveniences for precise work, and then the stocks of set screws, studs and other ready-made small parts of machines.

It would be absolutely impossible to get along now without the twist drill, and yet it has always been and is still an imperfect and a more or less unsatisfactory instrument. It is probably correct to say that for the accomplishment of its special work it is less perfect and satisfactory than either our taps or our reamers, although they also are constantly receiving suggestions of improvement.

The Farmer drill, which is not twisted, can scarcely be considered an improvement upon the twist drill. Sufficient evidence of it would seem to be in the fact that it is still not widely used. The practical objections to it would seem to be sufficiently evident. The cutting edge has not the proper inclination for easy cutting, the chips are not drawn out of the hole by the revolution, and the drill will not properly resist the twisting strain. We have seen many Farmer drills twist back-

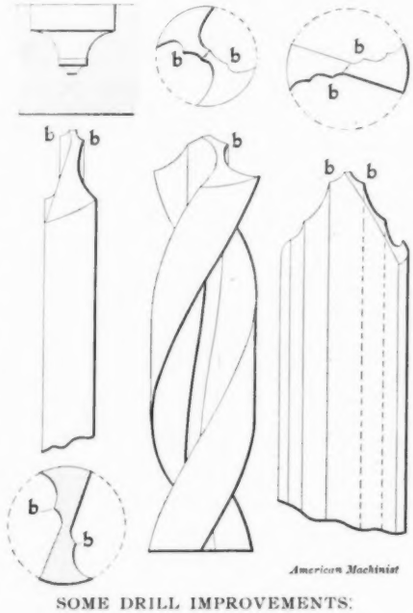
wards, then catch in the hole and either break or stop the machine, and, of course, injure the hole.

There are still many good mechanics who do not quite understand that the twist drill will resist torsion much better than the Farmer drill, or why it should do so, just as many also do not know why a wagon wheel is made dishing, a thing that we are frequently asked to explain. The Farmer drill has only the stiffness of the actual section of it to resist the turning, so that the thicker it is the better, especially at the edges; but in the twist drill another condition comes in to assist. If the twist drill should untwist at all, under the strain of the cut or by catching in the hole, it must necessarily elongate, and especially at the outside. The twisting movement would not produce any elongation of the center; but for any elongation to occur at the periphery, the entire section of the drill must be carried longitudinally, and this is impossible except by tearing the material at the center. The untwisting of the drill is thus resisted by a compressive strain of the metal at the periphery, and by a tensile strain at the center. The necessity of considerable ability to resist the tensile strain upon the material at the center of the drill makes it also necessary to have the drill thicker at the actual center than it otherwise would be, and this thickness of the drill at the center constitutes one of the chief objections to the drill at the present day. In the drilling of a hole by any twist drill, there is always at the center a little flat spot that is not cut, but is rubbed off by a quite obtuse angle of the steel.

The "American Machinist" has lately shown several devices for lubricating the twist drill while cutting by conveying, through holes or grooves, the oil as near as possible to the point and to the actual cutting edges of the drill. This is, of course, a move in the right direction, tending to promote both the efficiency and the longevity of the drill; but still the objectionable feature of having to rub off the metal at the center with a slow-moving obtuse angle of metal, instead of cutting it, remains. A device that will give us a thinner center for the twist drill, other things being equal, must be an improvement.

In this connection our attention has been called to a recently issued patent for an improvement upon the twist drill, which is at least worthy of notice. We have had no communication with the inventors, who are residents of Berlin, Germany, and all our information is from the patent papers. The specifications accompanying the patent curiously omit all reference to the objections we have been speaking of, but the drill as shown seems to suggest the means for at least partially overcoming them. The section of the cutting bar seems to be assumed to be equally applicable to the straight or Farmer drill and to the twist drill, and no intimation is given that either is considered preferable to the other.

By reference to the figures it will be noticed that the body of the drill is not made with a single curved groove on each side, but that each side groove consists of two or more curves with an angular projection at *b* on each side of the drill and near the center. The effect of the peculiar section is that the chip is not severed in a single sheet by each lip, but is constantly divided into two or more separate chips, and the drill has practically at its center a little drill cutting an advance cavity, which serves as a guide for the following portion of the drill. The projecting angles *b b*, and the consequent thickening of the section at those two opposite



SOME DRILL IMPROVEMENTS.

points also strengthen them to take the tensile strain accompanying the cutting tendency to untwist the drill. The additional tensile strength provided at *b b* makes less tensile strength necessary at the center, and consequently the drill may be made thinner at the center, and therefore easier cutting.

There is, for another reason, still some question as to how thin the center of the twist drill may safely be made. The opposing cutting strains of the two opposite faces would seem to involve a shearing strain up through the center of the drill, if we did not remember that the power to drive each lip is presumably transmitted down through it alone. There are still many points both for discussion and experiment in connection with the twist drill.

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Business at the shipyards on the great lakes is at this time particularly good; practically all the shipbuilding yards having plenty of work, and some of them work engaged enough to keep them busy for some time.

The Non-Corrosion of Iron Beams.

A year or two ago a report was widely circulated and obtained general credence to the effect that when the building of the "New York Times" was pulled down for the erection of the new building, the iron beams of the old structure were so rusted as to be in a very dangerous conditon. The same report was used by Mr. M. P. Wood in the presentation of his paper upon "Rustless Coatings for Iron and Steel" at the recent meeting of the Mechanical Engineers. Mr. Gilbert E. Jones, of the Park Company, owners of the Times Building, now says that "the report was not based on correct information." Mr. Jones further says: "Only the overhead beams in the kitchen of the restaurant, which occupied a part of the basement of the old building, were found slightly rusted. They were affected by the great quantities of steam generated in the kitchen. They were not very much affected, however, and it is surprising that they were not more affected by the steam, as no care was taken of them. Outside of this, the beams throughout the building were perfect, and were used in the construction of the new building. With the one exception, the first four stories of the new Times Building, from the subcellar up, have the same floor beams as the old.

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There is, after all, an impassable limit to the height to which the tall office building may go, so that there is no cause for alarm in that direction. A speed of 400 feet per minute for elevators is all right; but when you begin to run them at 500 feet a minute, accidents begin to happen. We are gravely assured by high engineering authority that as 400 feet per minute is the highest velocity compatible with safety, the obvious deduction is that when this fact is realized it will be difficult to attract tenants to buildings where, to give adequate service, the elevators must move much faster than that. It must be a great relief to have this settled.

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It is reported that it is quite probable a bill creating what will be known as an "Industrial Commission," will pass both houses of Congress at this session. The commission will be composed of twelve men—three representing labor, three agriculture, three manufacturing, and three business or commerce—and it will be the duty of the commission to collate information and recommend legislation to meet the problems presented by labor, agriculture and capital. The terms of office are to be two years, and salaries $5,000 per year with traveling expenses.

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The report of the Commissioner-General of Immigration for the year ending June 30, 1896, shows that 343,267 per-

sons sought admission to the United States during the year. Of that number, 41 gave their occupation as engravers, 1,393 as blacksmiths, 710 as engineers, 461 as iron workers, 624 as locksmiths, 534 as machinists, and 113 as wheelwrights.

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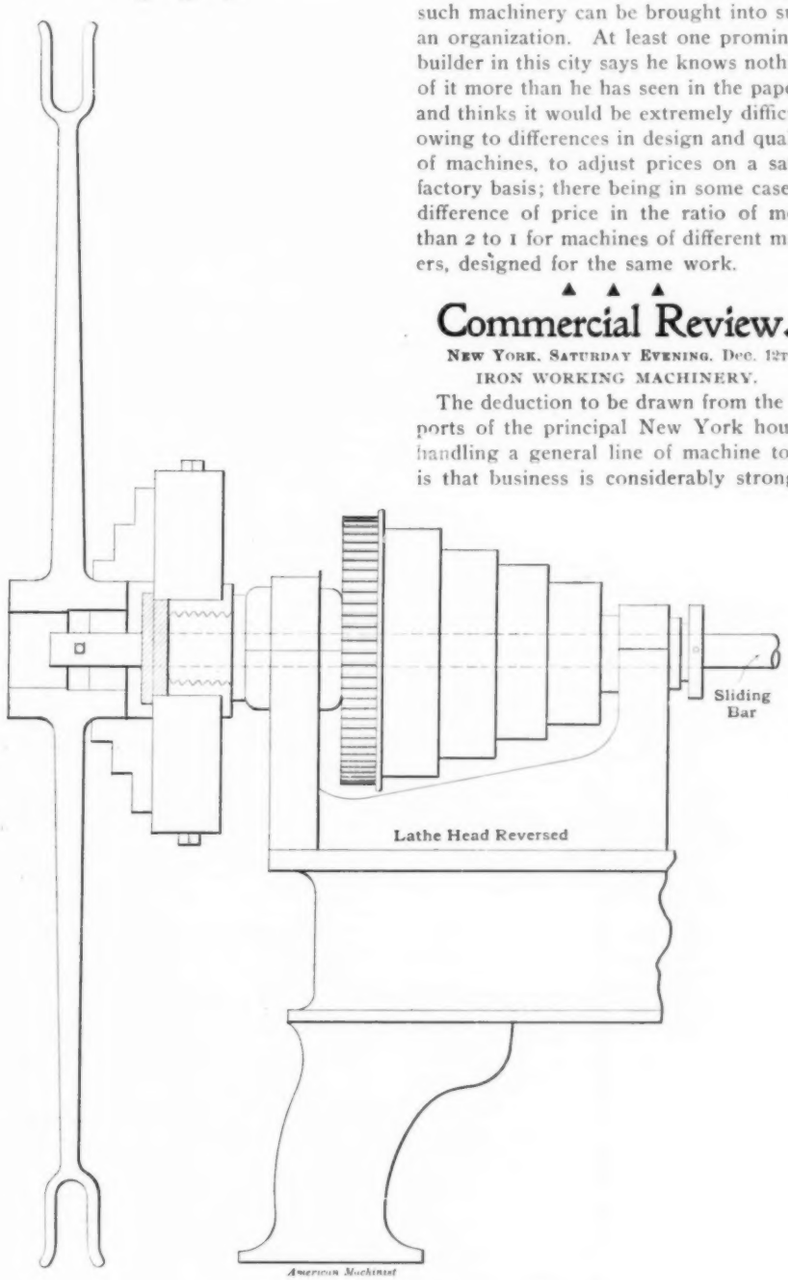

A NEW USE FOR A HOLLOW SPINDLE.

L. C. Sharp, of Omaha, Neb., sends us the above sketch. He sends no letter explaining it, and, in fact, none seems to be needed. Note the way in which the chuck is mounted on the spindle.

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Manufacturers of woodworking machinery are reported to have effected an organization of some sort. The Fay & Egan Company is most prominently mentioned in connection with it, but it is claimed that all the leading builders are interested. How this will affect the industry and the builders of such machinery cannot with any certainty be predicted, especially in the absence of information as to how the trust is to be conducted. It does not seem likely to us that all the builders of such machinery can be brought into such an organization. At least one prominent builder in this city says he knows nothing of it more than he has seen in the papers, and thinks it would be extremely difficult, owing to differences in design and quality of machines, to adjust prices on a satisfactory basis; there being in some cases a difference of price in the ratio of more than 2 to 1 for machines of different makers, designed for the same work.

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Commercial Review.

NEW YORK, SATURDAY EVENING, DEC. 12TH.

IRON WORKING MACHINERY.

The deduction to be drawn from the reports of the principal New York houses handling a general line of machine tools is that business is considerably stronger in tone than it was November 1st. In some cases sales appear to have increased to some extent, but the improvement in the situation is more owing to a feeling of quiet confidence that the market can be said to be, if not all that may have been anticipated, at least in a sound condition. The past week has been very quiet, which is attributable to the approach of the end of the year with its accompanying inventory-taking.

The railroads have not yet begun to buy heavily, in this city, at least. They will probably not do so until the gradual improvement in business has brought in to them greater earnings, or not until they have made up for the present year as good a financial showing as the circumstances permit.

The following statement from a certain large establishment is about the most favorable we have heard: "Our mail is three or four times as large as it has been during the year. Inquiries come from the New England cities and elsewhere. The bulk of the bicycle tool business is over for the season, but we are expecting a large order from one of the companies in a few days. Some of them have split up and new factories have been started in consequence. There is now less demand from abroad for machinery than there has been, because the demand for bicycle machinery, which was at its height in the early part of the summer, is principally over for the season. We are, however, still making shipments."

It is not safe, however, to draw the general conclusion that the exports are diminishing.

In a conversation with Mr. Wm. S. Accles, who has had considerable experience with the introduction of American machine tools into England, and is now in this country, making his headquarters at 136 Liberty street, N. Y., we obtained his views as to the European, particularly the English market. Mr. Accles has met with such success that he proposes to establish an agency for miscellanous American tools in London. He expects to go abroad again in January. He says:

"Machinery for bicycle manufacture has been the pioneer of American tools in Europe. I believe that it will lead to a greater demand for American machinery for other and more general purposes—for making locks, engines, gas engines, etc. It is probable that a heavier class of machinery, for the manufacture of which England is now celebrated, will, in the future be sought for in America.

"A cause which has tended to retard the introduction of American tools in Europe is the lack of permanent representation of the manufacturers, although they may indeed have fixed agencies there, and although this year they have had temporary representation from home. What is needed are men who understand the tools and who understand the ins and outs of foreign business.

"The foreign demand for bicycle machinery still continues. Early in the summer, manufacturers were perfecting their plans. Buying took place during the summer and continues, and will continue, as a result of the annual cycle shows in London, the Stanley and the National."

It does not seem as if sellers altogether agree as to just when the season of the year for bicycle tool business closes. The matter is a little differently stated in the

two preceding opinions on the export trade. We believe that in this country, as well as abroad, most of the new factories, so far as there may be any, have already bought their initial equipments, but that considerable, if not the bulk of the domestic business in supplying tools for factories already started is reserved until after the cycle shows to be held in New York and Chicago, early in the year.

Mr. H. F. Frevert, representing the Garvin Machine Company, of this city, has just returned from a successful foreign trip. His efforts with the large manufacturers in European trade centers resulted not only in a large business at the time, but in an excellent prospect for future orders.

Says a leading machine tool dealer: "There are in this country great facilities for overproduction in manufacture, but we keep our business going by putting our tools in place of those which are ancient and not honorable. We substitute the 1896 types for the 1796."

WOOD WORKING MACHINERY.

No great activity has struck this branch of the market, though inquiry seems to have improved somewhat in the last six weeks, and one or two concerns speak of fairly good sales.

A meeting was held in Cincinnati this week by some of the manufacturers of wood-working machinery, with a view, it was said, to a consolidation of interests. In this, Mr. Thos. P. Egan, of the J. A. Fay and Egan Company was a prime mover and the S. A. Woods, Rowley and Hermance and other concerns were to be included. It is stated that an option upon 80 per cent. of the stock of the wood-working machinery establishments in the country has been obtained, but that the percentage is so great is not credited by all in the business. We have not yet learned that the matter has assumed concrete shape, and whether it will do so is a matter open to question.

EXPORT SHIPMENTS OF MACHINERY

of miscellaneous character from the port of New York, as contained in cargo manifests given out during week ending December 12th, we compute at $470,692.

THE IRON MARKET.

Reports in this quarter show that the pig iron trade is quiet. A leading firm state that their business is limited principally to car-load lots, although a few parties who wish to anticipate the buying movement next month are showing themselves.

It is stated that the Tennessee Coal, Iron & Railway Company, the largest producer of Southern pig iron, has sold more of it during the past month to foreign dealers than to American consumers.

The tactics of various trusts and combines constitute an interesting subject of the day. The steel billet men, in session this week in Pittsburg, have agreed upon an open market until April 1st, which is understood to mean low prices, and explains why the Illinois Steel Company decided to pass its dividend.

Quotations.

NEW YORK, Monday, December 14th.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$12 00 @ $13 00
No. 2 foundry, Northern	11 50 @ 12 00
No. 2 plain, Northern	11 25 @ 11 50
Gray Forge	11 00 @ 11 50
No. 1 foundry, Southern	11 75 @ 12 00
No. 2 foundry, Southern	11 25 @ 11 50
No. 3 foundry, Southern	10 75 @ 11 00
No. 1 soft, Southern	11 25 @ 11 50
No. 2 soft, Southern	10 75 @ 11 00
Foundry forge, or No. 4 Southern	10 50 @ 11 00

Bar Iron—Base—Mill price, in carloads, on dock; common, 1.15 @ 1.20c.; refined, 1.25 @ 1.50c. Store prices: common, 1.40 @ 1.50c.; refined, 1.50 @ 1.80c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some brands perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward

Machinery Steel—Ordinary brands, from store, 1.65 @ 1.75c.

Cold Rolled Steel Shafting—Base size in carloads, about 2½c.; 2¾c. for smaller quantities from store.

Copper—Carload lots, Lake Superior ingot, 11.30 @ 11½; electrolytic, 11¼ @ 11¼c.; casting copper, 11 @ 11¼c.

Pig Tin—For 5 and 10-ton lots, 13.00c., f.o.b.

Pig Lead—In carload lots, 2.97½ @ 3.05c., f. o. b.

Spelter—In carload lots, New York delivery, 4.15 @ 4.25c., f. o. b., for ordinary brands.

Antimony—Cookson's, 7¼ @ 7½c.; Hallett's, 6¾c.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 40 @ 43c.

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Help Wanted.

Situation and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our subscription list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Help Wanted—Good pay for leisure hours. Geo. W. Lord, Philadelphia, Pa.

Position wanted as f'rman or supt. by exp. mech.; held such positions before. Box 194, AM. MACH.

Foundry foreman open for position; A 1 references. Address Box 196, AMERICAN MACHINIST.

Experienced man desires position as foreman in brass foundry; best references. Box 208, AM. MACH.

Experienc'd mech'nical drftsman wants position; best references. A. Seewaldt, 10 Ave. C, New York.

Wanted—Six young men of fair education who have had some experience, to learn the machinist's trade. Box 207, AMERICAN MACHINIST.

Man of long experience desires situation as superintendent or foreman of brass work; reference; temperate. Box 211, AMERICAN MACHINIST.

Practical and successful designer, A 1 draftsman, 20 years' varied experience, designer of high grade engines, desires position. Box 263, Ridgway, Pa.

Tech. graduate with 4 yrs.' experience in locomotive works, 1 as asst. superintend't of stove works, desires position; references. Box 195, AM. MACH.

Mechanical draftsman, 14 yrs.' experience in shop and office, good references, wishes position, New York City or New Jersey. Box 206, AMER. MACH.

Wanted—Young man with good practical experience in England and United States wishes to represent an American manufacturer; can hustle. Box 201, AMERICAN MACHINIST.

Mechanical Draftsman Wanted—One who has had experience and is capable of designing special automatic machinery for working iron and brass castings. Address Box 210, AMERICAN MACHINIST.

Do you wish to reduce expenses?—An energetic supt., 35, desires change; is thoroughly reliable and can come well recommended; machine tool shop pref'd; capable of taking entire charge of plant and is not afraid of overwork. Box 212, AMER. MACH.

Wanted—Position with mfg. company as designer of special machy.; practical machinist and draftsman, technically educated, modern methods, familiar with mill and factory work; would accept position as master mechanic. Box 205, AM. MACHINIST.

Wanted—Superintendent for a machine tool factory employing about 75 men. Party must be competent to figure, design and improve machines, handle men and produce work at a low cost; state past experience in this line and salary expected. Box 213, AMERICAN MACHINIST.

Foreman boiler-maker wanted—First-class man who is familiar with marine and stationary boiler and iron ship work. Applicants will state age, experience, nationality, give names of previous employers, and must be well recommended. Address Waring & Dixey, 2033 American Tract Building, N. Y. City, N. Y.

Jacquard Machinist—Schaum & Uhlinger are desirous of securing the service of a first-class practical and experienced Jacquard machinist to take charge of their Jacquard department. All communications confidential. Address in writing, giving full particulars of experience. Schaum & Uhlinger, Philadelphia, Pennsylvania.

A thorough machinist, age 36, who has been engaged in the machine and foundry business, desires to connect himself with some reliable firm where ability and push will count; well up in modern shop methods and management; can handle men, make drawings, solicit business, make contracts or handle correspondence; can give unqualified references as to character and ability. Box 179, AMERICAN MACHINIST.

A 1 expert and thorough mechanic on gas and gasoline engines, at present holding responsible position with large concern manufacturing gas engs., wishes to change by Jan. 1st; will accept position as manager or as general traveling salesman and expert with a firm that appreciates ability and inventive genius developing gas engines to highest efficiency, and electric lighting with same, a specialty. Box 209, care AMERICAN MACHINIST.

Wanted—A thorough, practical mechanic as general foreman in high-speed engine works equipped with modern tools, employing about 100 men; must be familiar with machine work particularly and foundry and pattern work generally; should be skilled in modern methods of tool making and jig work and must be a good handler of men; an especially good man is desired; state salary wanted and give record of present and past work. Box 200, AM. MACHINIST.

▲ ▲ ▲

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

All kinds of engines and machinery built to order. New Jersey Machine Works, Newark, N. J.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

$5,000 buys one-third interest in a foundry and machine shop in the garden of Minnesota; well established business; excellent reasons for wanting a third partner. Box 193, AMERICAN MACHINIST.

We offer an exceedingly fine lot of first-class second-hand machinery, lathes, planers, shapers, drills, millers, screw machines, etc. Call, or get list 17 B. The Garvin Mach. Co., 440 Canal st. N.Y.

Wanted—An Idea. Who can think o some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

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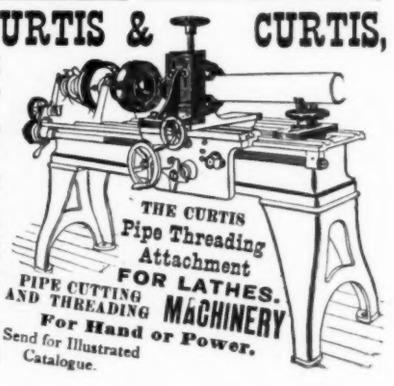
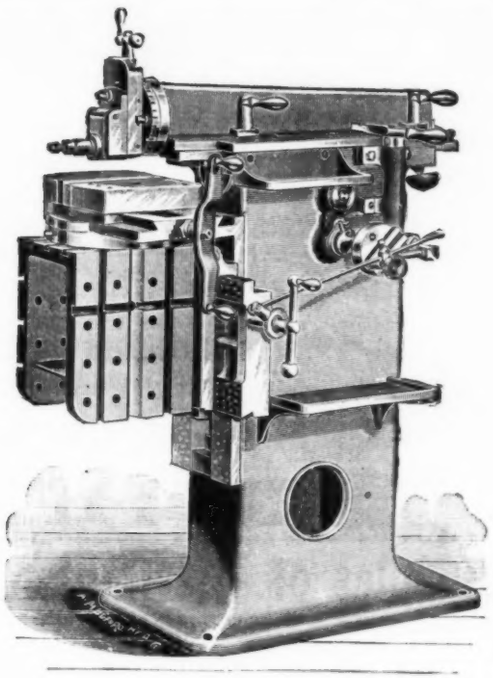


Send for Illustrated Catalogue.



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Latest Improvements.
Useful Attachments.
Strong and Powerful.

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Die Work, Tool Room or General Shop Work.

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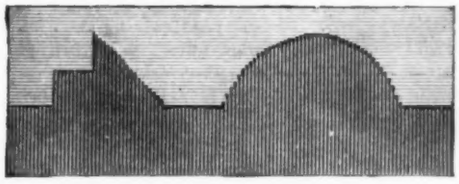
The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

▲ ▲ ▲ ▲

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European Agents, CHAS. CHURCHILL & CO., London and Birmingham. SCHUCHARDT & SCHUTTE, Berlin and Vienna. EUGEN SOLLER, Basel, Switzerland.

Manufactures.

Joseph Turcotte, of Oscoda, Mich., intends to erect a foundry.

Mr. W. W. Cummer is to erect a new saw mill at Jacksonville, Fla.

A new silk mill is to be erected at Ephrata, Lancaster County, Pa.

The Wheeler Projectile Works, McKeesport, Pa., are to be enlarged.

The Douglass Glass Company intend to erect a factory at Trenton, N. J.

The works of the Sterling Steel Co., McKeesport, Pa., will shortly be enlarged.

At Egg Harbor, N. J., a new pumping station and power house are to be erected.

The Black Crook Company, Lake City, Colo., intend to erect a machine shop.

H. H. Lysinger, Bedford, Pa., is to erect a new steam flour mill at that place.

The Austin Mining Company intend to erect a new mill at Salt Lake City, Utah.

The Rapid Railway Company expect to erect a power house at Mt. Clemens, Mich.

A new match factory is to be erected at Newport, Pa., by L. A. Wolfe, Lebanon.

The new Slater mill at Webster, Mass., is to have considerable new machinery installed.

Arad Fossett, Pimaquid, Me., is contemplating placing new machinery in his steam mill.

The Balbach Smelting & Refining Company, Newark, N. J., are erecting a new boiler house.

Mr. A. F. Burnot, Philadelphia, Pa., is about to add three additional stories to his dyeing factory.

Gebhart & Estabrook will rebuild their planing mill at Saginaw, Mich., which was recently burned.

The Seaboard Air Line will shortly make extensive improvements to its shops at Portsmouth, Va.

The Lorain Foundry Company, of Lorain, O., will commence active operation of their plant on January 1st.

Robert Wetherill & Co., Chester, Pa., have plans made for the erection of a new and modern foundry.

At Warren, O., the Day-Ward Manufacturing Company have decided to make a large addition to their plant.

A. B. Clark's new wool pulling factory at Peabody, Mass., is in process of erection. It is of large proportions.

Alterations are to be made at the Cayadutta Chemical Works, Gloversville, N. Y., and new machinery added.

The Ferrosteel Company, of Cleveland, O., have recently moved into their new quarters, 151 Water street, that city.

Carroll Bros. have purchased the old rolling mill at Houghton, Mich., which will be fitted up for foundry purposes.

Geo. Dalrymple has purchased some land at Fairhaven, Vt., on which he will erect a shop for the production of tubing.

At Millersburg, O., the Brightman Manufacturing Company intend to erect a plant to manufacture shafting, pulleys, etc.

The Dalton & Lark Company, Bingham, Salt Lake City, Utah, are contemplating the erection of a reduction mill at that place.

The Joseph Banigan Rubber Company, Providence, R. I., have purchased the old Faxon mill, and an addition of 200 feet will be made to it.

W. H. Painter is to erect a hat factory at 1118 North 2d street, Philadelphia, Pa. The most improved type of machinery will be installed.

It is reported the American Cotton Picker Company, of Pittsburgh, Pa., will erect a plant for the manufacture of cotton pickers at Norfolk, Va.

The old round-house and shops recently occupied

by the B. & O. R. R. at Cumberland, Md., have been leased, and it is said a sash factory will occupy them.

The Marion Manufacturing Company, of Stoughton, Mass., are having an addition put on their building. New boiler and machinery will be installed.

The American Screw Company, Providence, R. I., will, in the near future, erect a rolling mill plant for the production of the raw material used in its factory.

The Albright & Wilson Electro-Chemical Company, of Great Britain, has closed a contract with the Niagara Falls Power Company, Niagara Falls, N. Y., and will locate in that city.

A new company, of which J. H. McKenzie, W. H. Spurgeon and F. G. Peck, all of Colorado Springs are the incorporators, intend to erect shops at that place to manufacture a patent car coupler.

Parkersburg Acid Works, Parkersburg, W. Va., contemplate the reconstruction of their plant. An entirely new concentrating apparatus is to be installed. Mr. W. P. Littleton is superintendent.

A new company, known as the Ohio Germanic Engineering Company, has been formed at Cleveland, O. Those interested are W. D. Richardson, Frank H. Robinson, Gustav J. Hall and Geo. H Morton.

Jaques Brothers & Co., of Boston, Mass., have bought the plant of the Suffolk Spring Bed Company, Suffolk, Va., and will remodel the same for the manufacture of moldings, etc. New machinery will be installed.

A new company, called the American Impulse Wheel Company, has been formed in New York. Directors: Herbert P. Campbell, Hoboken, N. J.; John P. Millard and Frank Lawrence, of New York City, and others.

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New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

Curtis & Curtis, Bridgeport, Conn., send us a catalog devoted to the illustration and description of pipe cutting and threading machinery, including pipe dies and taps, die stocks, etc. It is 8¼ x 9½ inches.

The Waterbury Machine Company, Waterbury, Conn., send us a catalog which is especially devoted to the description and illustration of wire drawing machinery. A table of the standard wire gages in use in America is given. The catalog is 6¼ x 6¾ inches.

J. A. Fay & Co., Cincinnati, O., send us a pamphlet entitled "Cutter Heads, etc.," containing illustrations and descriptions of various kinds of cutters for molding, tenoning, mortising chisels, etc. This pamphlet will be sent to those desiring it upon application, and is 8¾ x 10½ inches.

Frank Pearn & Co., Ltd., West Gorton, Manchester, England, send us a catalog illustrating and describing various forms of machine tools, including radial drills, pipe facing machines, tappers, etc. Detailed descriptions of the different parts of the machines named are given, and the catalog is 5¼ x 8 inches.

Ranken & Fritsch Foundry & Machine Company, St. Louis, Mo., have issued their catalog containing illustrations and descriptions of various sizes of Corliss engines. This catalog gives very full descriptions of the parts of these engines, and also half tones of the engines complete and in service. The catalog is standard size, 6 x 9 inches.

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Fine Machine Tools.

Complete Plants furnished for Bicycle, Typewriter, Gun and Sewing Machine Makers. Gauges and Small Tools for all Machine Work. Drop Hammers and Trimming Presses. Forging and Trimming Dies for all classes of work.

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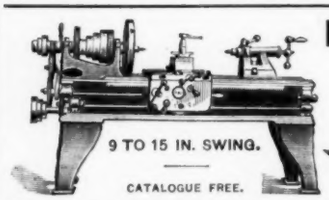
325 Pages. 433 Cuts. 8vo, Cloth, $3.00.
JOHN WILEY & SONS, 53 E. 10th Street, New York City.



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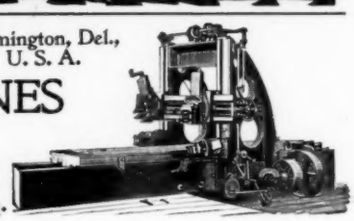

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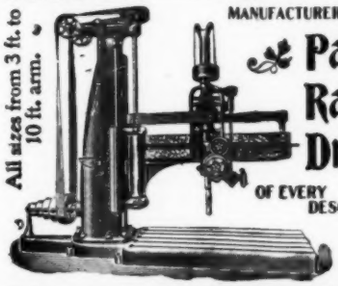

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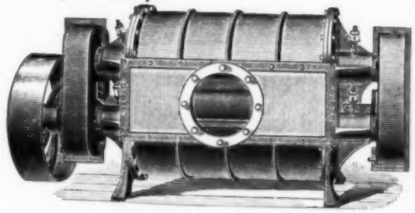

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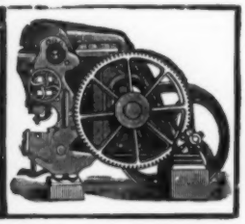

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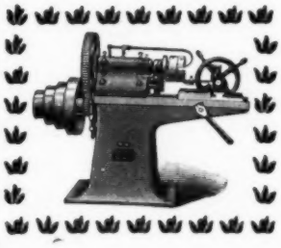

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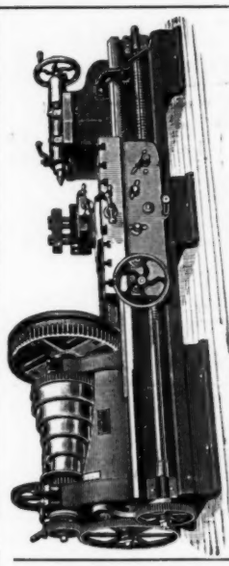

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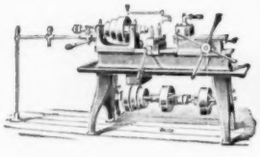

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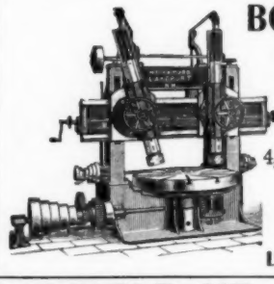

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